University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring- 2012
Program: B. Sc. Engineering (Civil)

Course Title: Principles of Accounting | Course Code: ACN 301

Time: 2.00 Hours | Full Marks: 100

There are **Six** Questions. Answer any **Four.** All questions are of equal value. Figures in the right margin indicate marks.

1. (a) Explain "Monetary Unit Assumption" and "Economic Entity Assumption". 05
   (b)State the "Cost Principle". 04
   (c) Mr. Mehadi started his own consulting firm and state the following transactions for the month of December 2011: 16

   Dec-1: Invested Tk.20, 000 cash and equipment Tk. 15,000 in the business.
   Dec-3: Paid Tk.2, 000 cash for office rent.
   Dec-7: Purchase equipment for Tk.8, 000 on account.
   Dec-8: Incurred Tk.500 of advertising cost on account.
   Dec-10: Purchase office supplies for cash Tk.1, 500.
   Dec-15: Performed Tk. 7,000 of service on account.
   Dec-18: Paid for the equipment purchase on December 7.
   Dec-20: Received a cash payment of Tk. 5,000 for service provided on account on Dec-15.

   Required: Show the effect of the above transactions on the accounting equation/ prepare a tabular summary of the above transactions.

2. (a) What is a ledger? When is it prepared? 05
   (b) Miss Afroza Rahman is a licensed architect. During the first month of the operation of her business, the following transactions and events occurred.

   Nov-1: Invested cash Tk. 30,000 and equipment Tk. 10,000 in the business.
   Nov-3: Hired a secretary at a salary of Tk. 4,000 payable monthly.
   Nov-8: Purchase architectural supplies on account Tk.2, 500.
   Nov-10: Performed services and billed on a client Tk.15, 000 for services,
   Nov-11: Received Tk. 6,000 cash advance from a client.
   Nov-18: Received 80% of balance due from customers for services performed on Nov-10.
   Nov-22: Purchase equipment for Tk. 8,000 and paid 3,000 cash.

   Required: (a) Journalize the transactions. 15
   (b) Post the transaction into the ledger accounts. 05

3. (a) Is the preparation of Trail Balance a mandatory part of accounting system ? 08

(b) The Trial Balance of Tonni Massai Company at June 30, 2012 is shown below- 17

Tonni Massai Company
Trial Balance
June 30, 2012

Accounts Title	Debit(Tk.)	Credit (Tk.)
Cash	7,150	
Accounts Receivable	6,000	
Supplies	2,000	
Prepaid Insurance	3,000	
Office Equipment	15,000	
Accounts Payable		4,500
Unearned Service Revenue		4,000
Capital		21,750
Service Revenue		7,900
Salaries Expense	4,000	
Rent Expense	1,000	
Total	**38,150**	**38,150**

Analysis reveals the following additional data:

i. Supplies on hand Tk. 600
ii. A utility bill for Tk. 150 has not been recorded and will not be paid until next month.
iii. The insurance policy is for a year.
iv. Tk. 2,500 of unearned service revenue has been earned at the end of the month.
v. Salaries of Tk. 2,000 are unpaid at June 30.
vi. Service provided to a customer but not collected Tk. 1,000.
vii. Rent is accrued but not paid Tk. 1,000.
viii. Office equipment depreciates 100 per month.

Required: Prepare the adjusting entries for June 30, 2012.

4. (a) What is meant by the term Degree of Operating leverage? 05

(b) Z ltd is planning to sell certain product in the market. The product will be sold at Tk. 20 per unit. The variable cost for the product will be Tk. 12 per unit and fixed cost would be Tk. 80,000.

Required: 20

i. Calculate Break- even point in terms of quantity.
ii. Calculate Break- even point in terms of Tk.
iii. Calculate Margin of Safety at a sales level 2,50,000 units.
iv. Calculate the profit if 80,000 units are sold.

5. (a) What is Opportunity cost and Sunk cost? Explain with examples. 05

(b) The following information is available for Munnu Trading Company:

Munnu Trading Company
September 30, 2011
Trial Balance

Particular	Debit	Credit
Cash	5,400	
Accounts Receivable	2,800	
Prepaid Insurance	2,400	
Supplies	1,300	
Equipment	60,000	
Notes Payable		40,000
Accounts Payable		2,400
Capital		30,000
Drawing	1,000	
Service Revenue		4,900
Salaries Expense	3,200	
Utility Expense	800	
Advertising expense	400	
Total	**77,300**	**77,300**

Other data consist of the following:

a. Insurance expires at the rate of Tk. 200 per month.
b. There is Tk. 1,000 of supplies on hand at Sep, 30.
c. Monthly depreciation on the equipment is Tk. 900.
d. Interest of tk. 500 on the notes payable has accrued during September.

Required:

i. Prepare a Classified Balance Sheet assuming 30,000 of the notes payable in long term. 15

ii. Prepare an income statement. 05

6. Answer any five: 25

(a) What is Double Entry System?

(b) What is Bank Reconciliation Statement? Why is Bank Reconciliation Statement prepared?

(c) What is the difference between Cost, Expense and Loss?

(d) Explain behavioral classification of cost.

(e) State the steps in Bank Reconciliation Procedure.

(f) State the Accounting Procedure or Accounting cycle.

(g) What is the basis for comparison in Ratio Analysis?

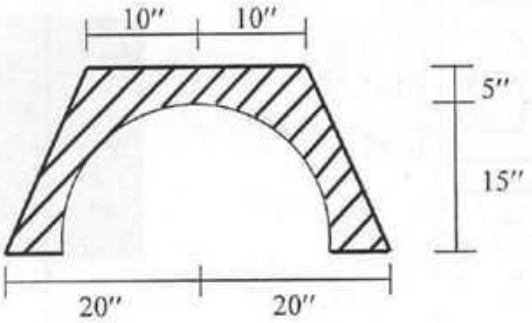
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

A

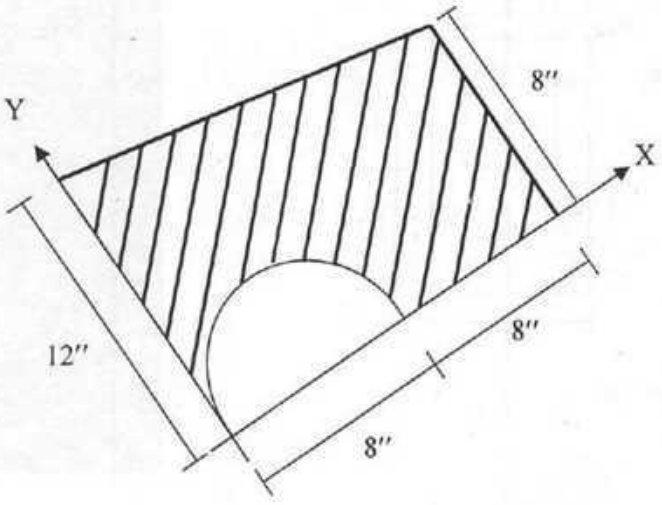
Course Title: Engineering Mechanics I — Course Code: CE 101
Time: 3 hours — Full Marks: 100(= 10 x 10)

[Answer **any 10 (ten)** of the following 14 questions]

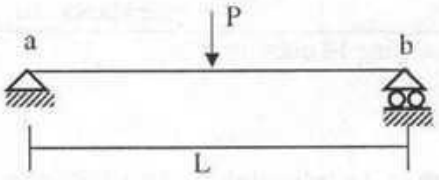
1. Determine the centroid of the shaded area as shown in the following figure. Choose the location and orientation of the axes according to your convenience.

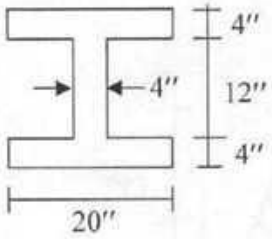


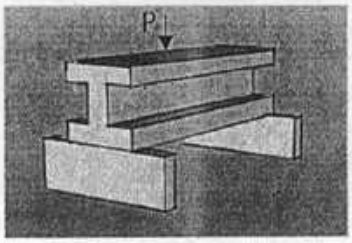
2. Determine the position of center of gravity of the shaded area. The location and orientation of the axes are shown in the figure.



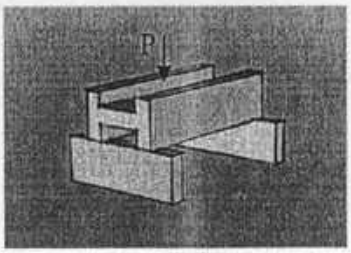
3. Suppose that you will have to transfer a constant vertical load "P" from support "a" to support "b" which are located at "L" distance from each other. You are provided with an "I-section" (dimensions are given in the following figure) to serve the purpose. Two possible orientations are shown in the figure below. Which orientation will you prefer? Why?





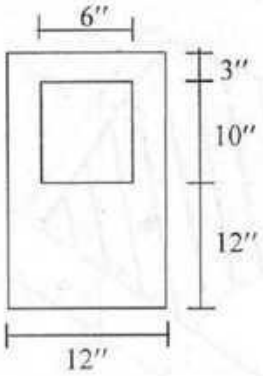


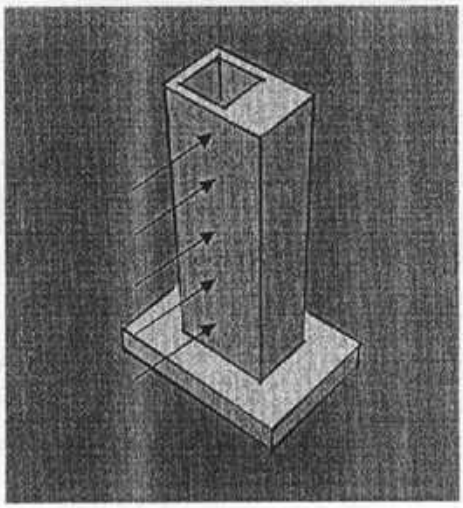
Orientation-1



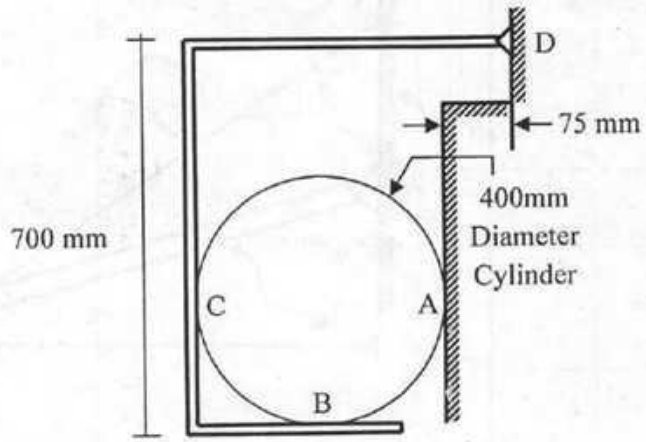
Orientation-2

4. A box-beam is loaded as shown in the following figure. Pay your attention to the direction of applied load. Calculate the moment of inertia that you think is relevant while considering the bending phenomenon of the beam under the load shown.

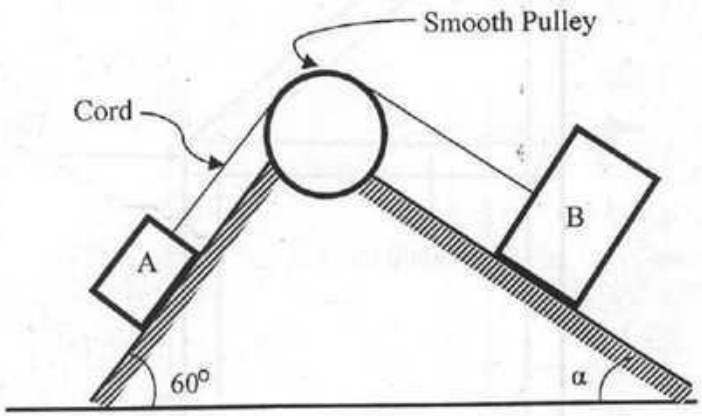




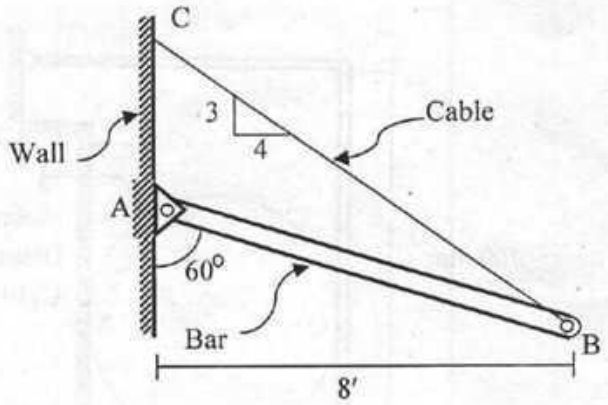
5. A 500 N cylinder is supported by the frame BCD as shown in the following figure. The frame is hinged at D. Determine the reactions a A, B, C and D. Assume all the surfaces to be smooth and also neglect weight of the frame.



6. In the following figure, the bodies A and B weighing 250 N and 320 N respectively rest on smooth inclined planes and are attached to each other by a cord (which passes over a smooth pulley). Determine the values of the angle "α" and the reactions at the inclined planes, if the bodies are in equilibrium.

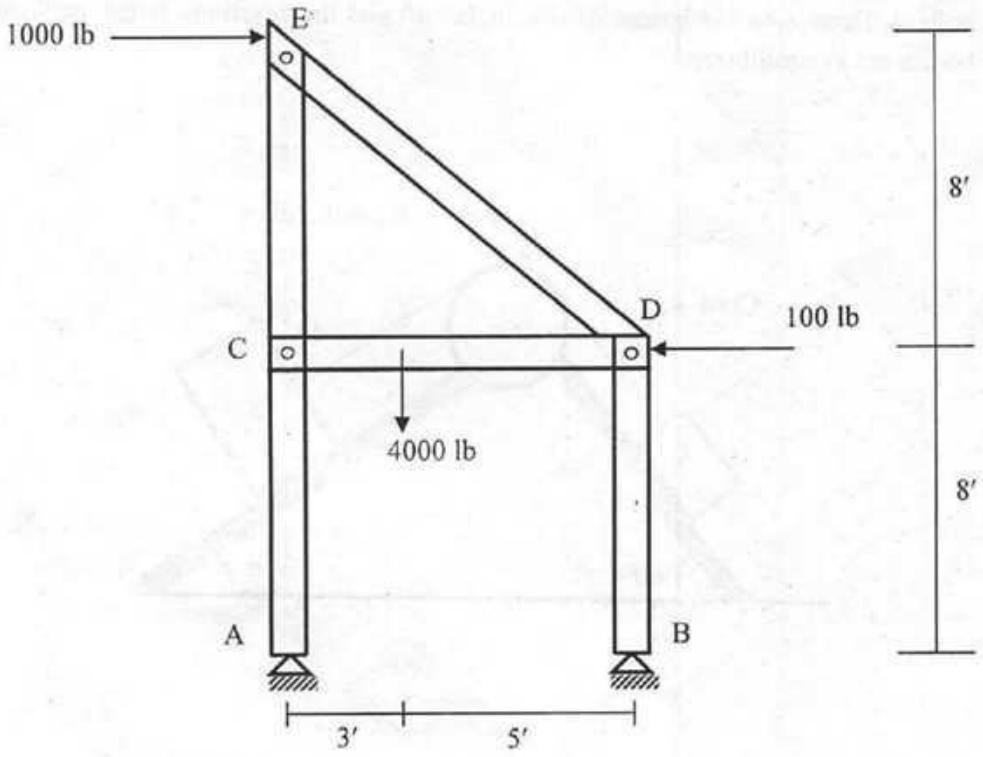


7. A bar of weight 1000 lb (pound) is hinged to a vertical wall at A and supported by a cable as shown in the following figure. Determine the components of pin reactions at A and C.

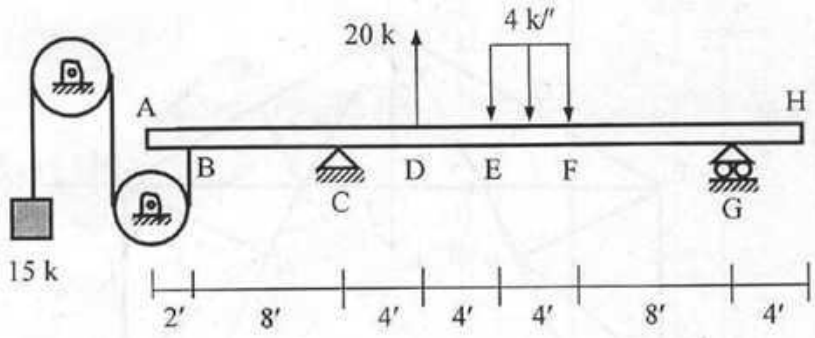


8. The frame shown in the following figure consists of two vertical members AE and BD, a horizontal member CD and an inclined member DE. All the members have been assumed to be weightless.

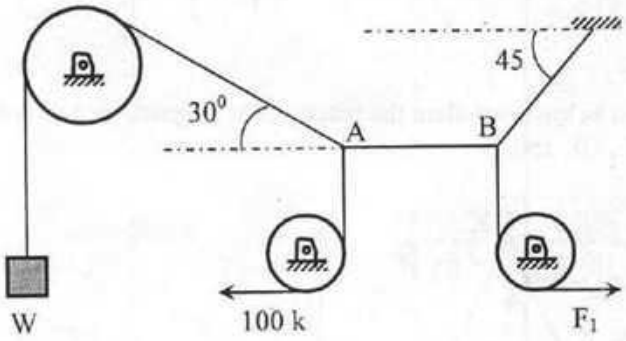
i) Identify the two force member(s)
ii) Calculate the components of pin reactions at A
iii) Determine the axial force in the two force member(s)



9. For the simply supported beam shown in the following figure, determine the reactions at the supports. Also calculate the magnitudes of shear force and bending moment at F.



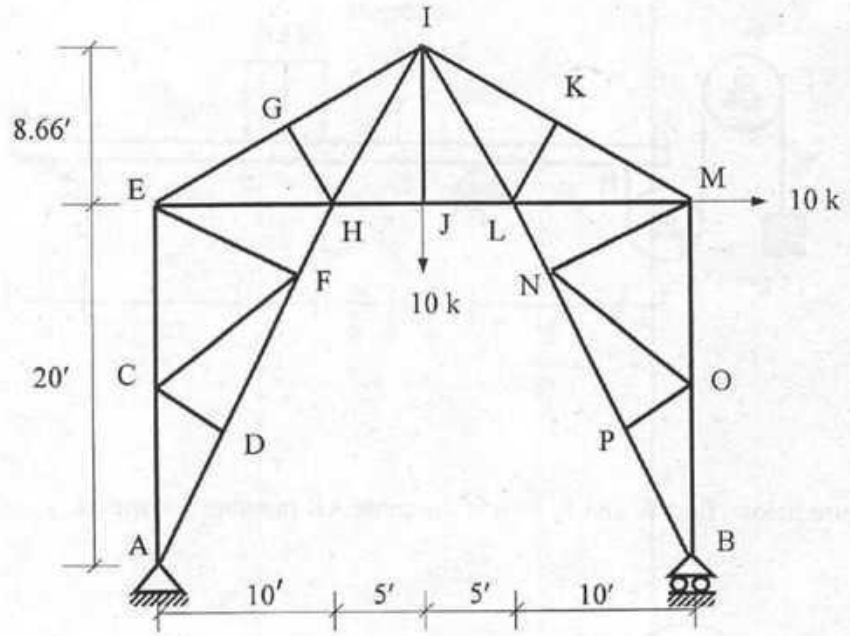
10. In the figure below, find W and F_1 so that the cable AB remains horizontal.



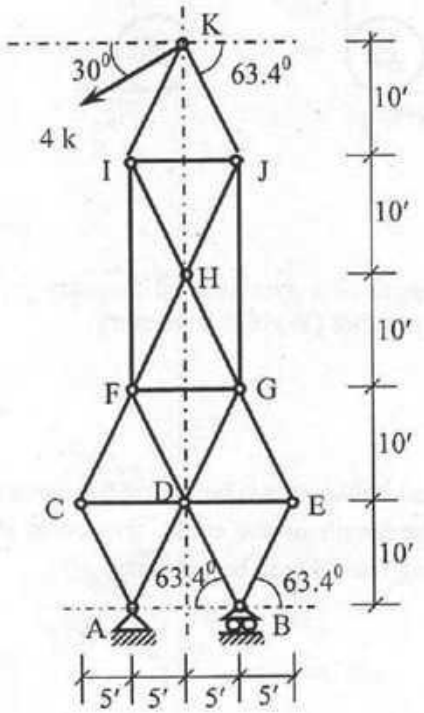
11. Derive the expression for the total length of a symmetrical catenary in terms of tension at low point (Q), span length (L) and weight per foot (W) of the catenary.

12. A cable weighing 2.5 lb/ft is suspended between two points on the same elevation with a span of 300 ft and sag of 30 ft. Calculate the length of the cable, tension at the lowest point and the tension at the support reaction assuming the cable to be catenary.

13. In the truss shown below, distinguish the zero-force members (without showing any calculations), compute the external reactions at the supports and the forces in the members PB, GI and HJ.



14. In the truss shown below, calculate the reactions at supports A and B and the forces in the members BD, DE, GE and IK.



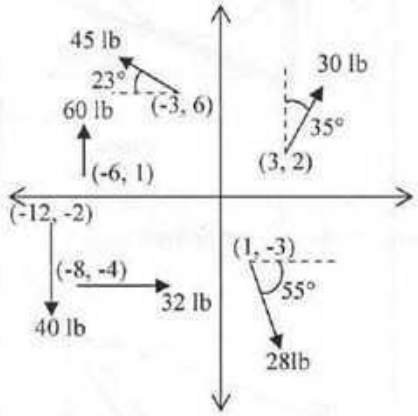
B

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
B. Sc. Engineering (Civil)

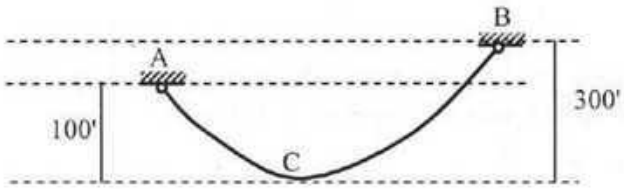
Course Title: Engineering Mechanics I | Course Code: CE 101
Time: 3 hours | Full Marks: 100 (= 10 × 10)

[Answer **any 10 (Ten)** of the following **14** questions]

1. Find the magnitude, direction and position of the resultant of the following force diagram.

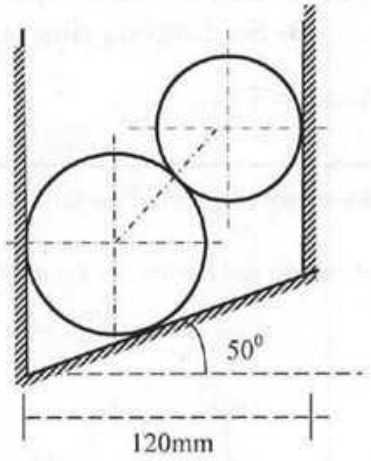


2. A 0.75" (dia) steel wire is supported between two supports as shown below. Tension measured in lower supported is 15kip.Determine the-
   (a)Tension at upper support
   (b)Total length of the cable
   (c) Horizontal distance between the supports
   (Assume **catenary**)

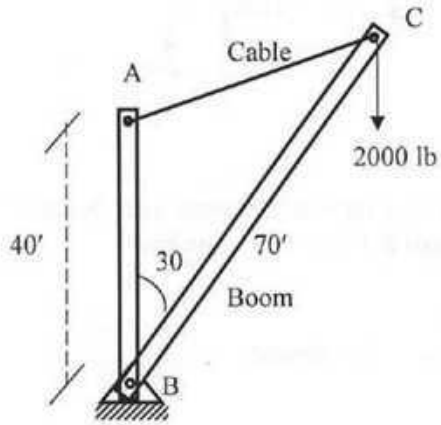


3. Derive the expression for the total length of a catenary cable in terms of horizontal length L, horizontal bottom tension Q and weight W.

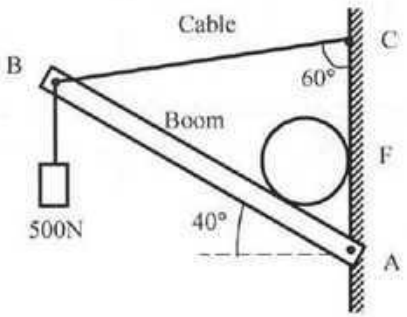
4. The system shown below is in equilibrium. The upper sphere weighing 50N has a diameter of 50mm and the lower sphere weighing 200N has a diameter of 100mm. Determine the wall reactions.



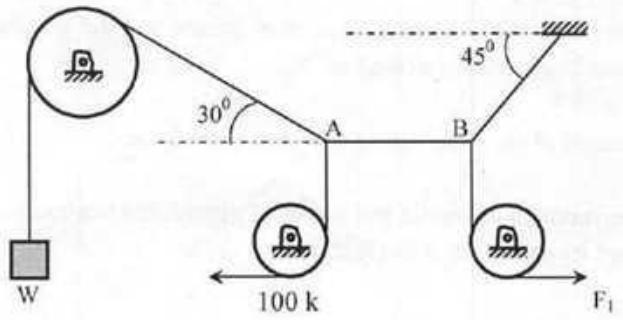
5. A derrick (assume weightless) shown below supports a load of 2kip. Find the tension in the boom cable and the compression in the boom.



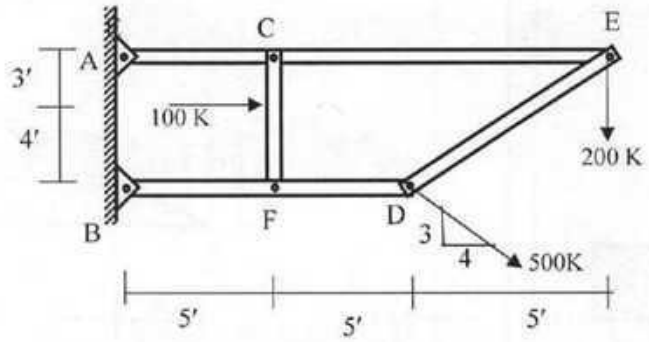
6. A 5m long Boom AB supports a 200N sphere (dia=300mm) as shown in the figure below. Determine the cable tension and reactions at A, E and F.



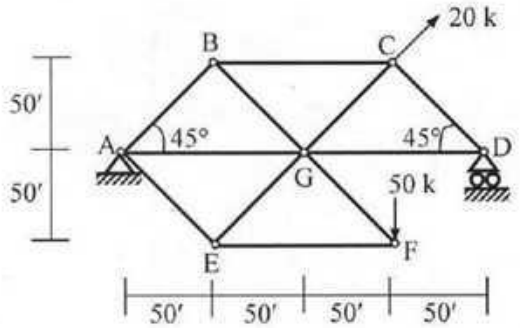
7. In the figure below, find W and F_1 so that the cable AB remains horizontal.



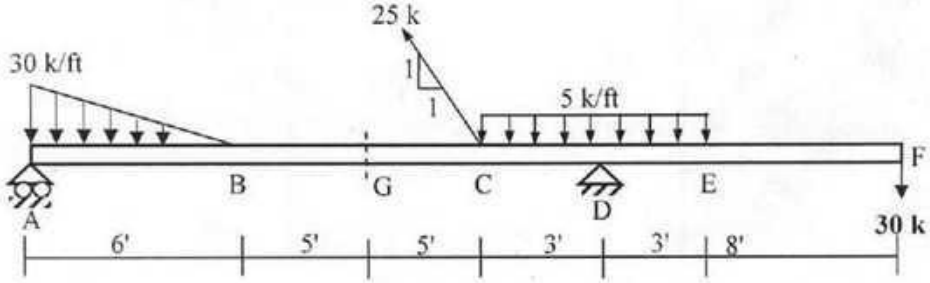
8. For the Frame shown below, calculate the reaction at A and B. Also find the bar force of two force members.



9. In the truss shown below, calculate the reactions at supports A and D and forces in members BC, CG and EF.



10. Determine the support reactions at **A** and **D** of the beam shown in the figure below. Also calculate the axial force, shear force and bending moment at point **G**.



11. Find the centroid of the following composite Area shown in Figure-1.

12. Calculate the moment of inertia and radius of gyration of the composite area shown in Figure-1 about its centroidal axis (X & Y).

13. Find the centroid of the composite Area shown in Figure-2.

14. Calculate the moment of inertia and radius of gyration of the composite area shown in Figure-2 about its centroidal axis (X & Y).

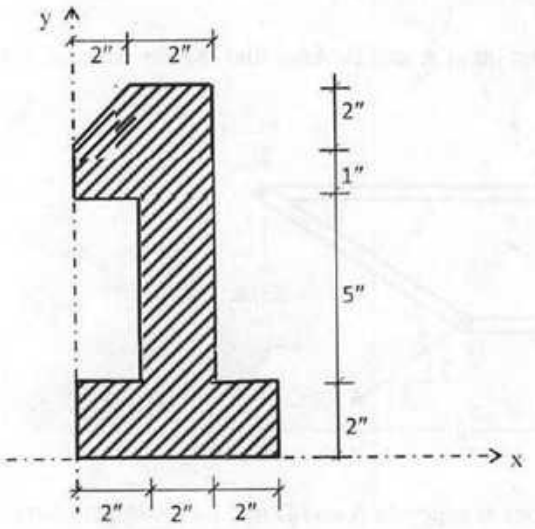


Figure-1

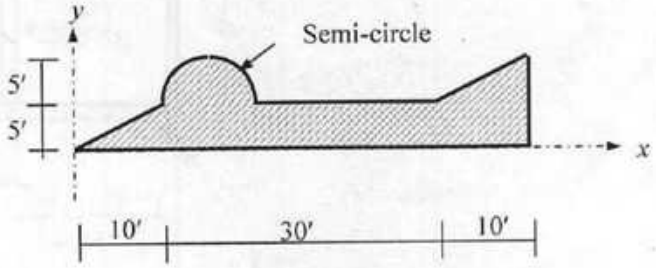


Figure-2

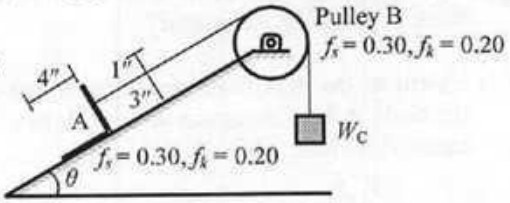
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012 (Set A)
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics II | Credit Hours: 3.0 | Course Code: CE 103
Time: 3 hours | Full Marks: 100 (= 10 × 10)

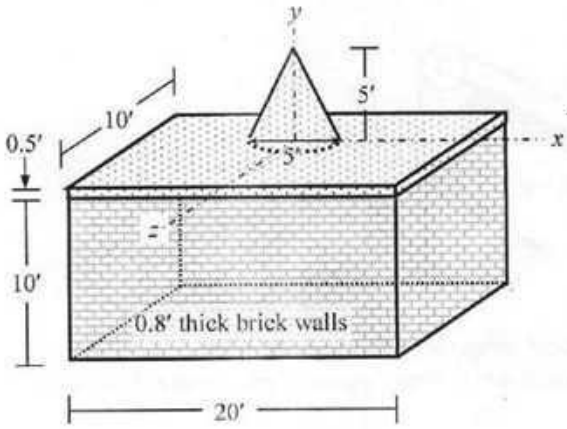
[Answer **any 10 (ten)** of the following 14 questions]

1. Figure below shows a (4″× 4″) L-beam A (W_A = 100 lb) being pulled along an inclined plane (θ = 30°) by a cable using weight W_C over pulley B.

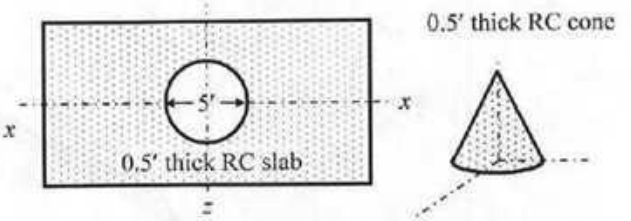
   Calculate the required weight W_C if the beam impends to (i) slide downward, (ii) slide upward, (iii) overturn [Given: f_s = 0.30, f_k = 0.20 for pulley and plane].



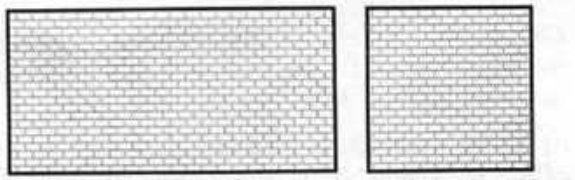
2. The figure below shows a (20′× 10′) room with 0.5′-thick RC slab and 0.8′-thick brick walls, as well as the four components it is made of. Calculate its mass moment of inertia about y-axis [Given: Unit weight of RC = 150 lb/ft^3, Unit weight of brick = 120 lb/ft^3].



Isometric View of Room

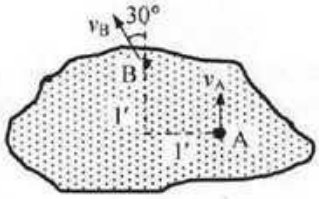


Component 1 (RC slab) | Component 2 (RC cone)



Component 3 (2 long brick walls) | Component 4 (2 short brick walls)

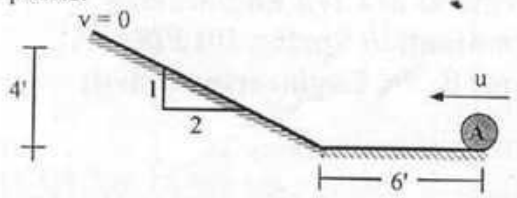
3. The plate shown below is spinning about its centro. If velocity of A is v_A = 10 ft/sec, determine the
   (i) location of the centro,
   (ii) angular velocity of the plate,
   (iii) normal accelerations at A and B.



4. A particle travels along a curve $y = 2x - x^2$ with a constant horizontal velocity v_x = 100 ft/sec. Calculate its
   (i) velocity when x = 0,
   (ii) acceleration when it reaches y_{max}.

5. Calculate W_C for the system described in Question 1, if the L-beam slides
   (i) upward, (ii) downward
   with an acceleration of 10 ft/sec^2.

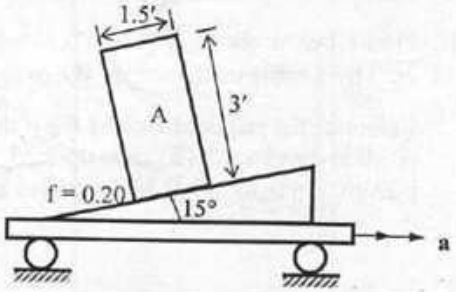
6. Calculate the initial speed (u) of block A if it comes to rest climbing 4' height of the inclined surface. Assume f= 1/3 for all planes.



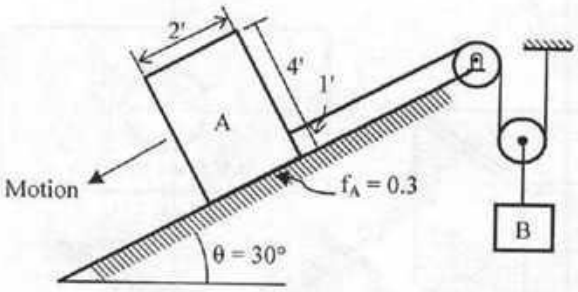
7. Homogeneous body A, weighing 300 lb, is loaded on a truck on an inclined surface as shown in the following figure.

(i) Will the body tip over or slide if the acceleration of the truck is gradually increased?

(ii) Calculate the maximum acceleration (a) of the truck, if the body A is to maintain its equilibrium position on the inclined surface.



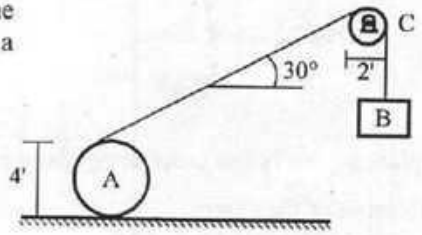
8. Figure below shows a homogeneous body A weighing 1000 lb. Assume the pulleys to be weightless and frictionless and determine the (i) weight of B when the body A is on the point of turning over, (ii) the weight of B when the body A is sliding down the plane at an acceleration of 1.5fps^2.



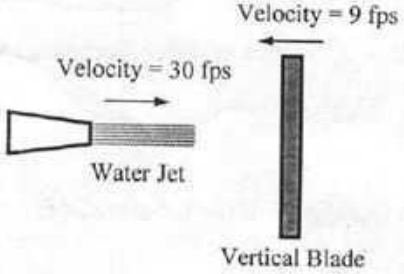
9. Disk A ($W_A = 80^{\#}$, $I_A = 4$ slug-ft^2) has a weightless cord wrapped about its mid section, as shown in the figure below. The cord passes over a frictionless and weightless sheave C and thence downward to weight B ($W_B = 50^{\#}$).

(i) If the system starts from rest, determine the speed of the cg of A and the acceleration of B, after B travels a distance $S_B = 20$ ft

(ii) What is the tension in the cord?



10. A cylindrical water jet discharges 150 lb/sec moving with an absolute velocity of 30 fps and strikes a flat plate whose surface is at right angle to the jet as shown in the following figure. Determine the force exerted on the plate by the water if the plate moves at 9 fps in the opposite sense as the water.



11. Once Newton was thinking sitting below an apple tree, when suddenly an apple fell from 5m height, hit his head and bounced back upward.

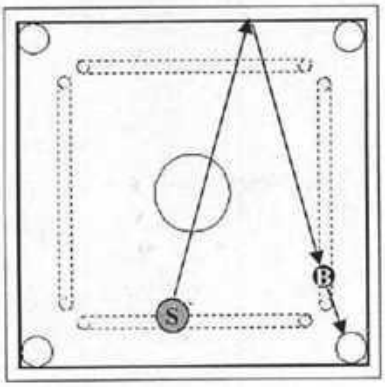
(i) Determine the velocity at which the apple hit Newton's head and the velocity at which it bounced back.

(ii) How far did the apple rise on rebound?

(iii) Calculate the loss of kinetic energy during the impact.

[Assume mass of the apple and Newton are 100 g and 70 kg respectively. Also assume the coefficient of restitution of Newton's head is 0.20].

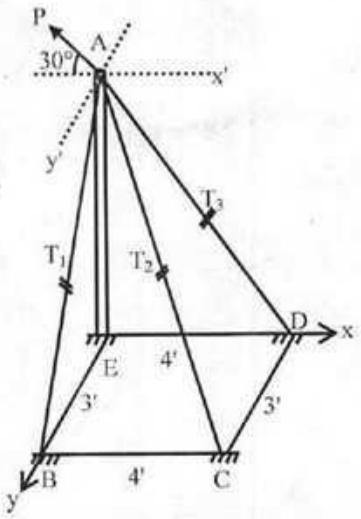
12. At the end of a board of carom only one black coin left. A player hit the striker in such a manner that it hits the black coin following the path shown in the following figure. The distance between the black coin and the nearest pocket is 0.5 ft.



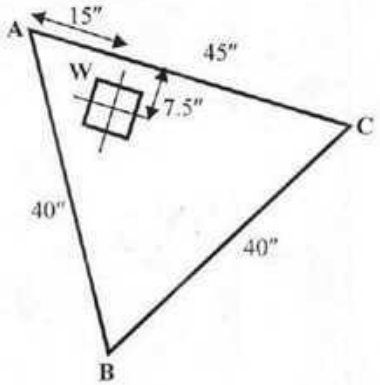
If the black coin travels the distance to pocket with a deceleration due to friction of 1 fps^2, determine the final velocities of the striker and the coin.

[Assume,
Coefficient of friction between striker and the board = 0
Coefficient of restitution between black coin and the striker = 0.2
Coefficient of restitution between striker and the board = 1
Mass of black coin = (2/3) x Mass of striker].

13. In the following figure AE = 10 ft and force P is in the plane x'-y'. The compressive force on AE is 1800 lb and T_1= 250 lb. Calculate T_2, T_3 & P.



14. As shown in the following figure, the weight W = 90 lb is placed on a weightless triangular table, which is supported at A, B and C. Calculate the support reactions.



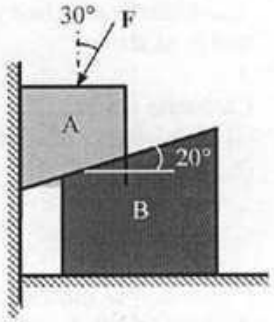
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012 (Set B)
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics II | Credit Hours: 3.0 | Course Code: CE 103
Time: 3 hours | Full Marks: 100 (= 10 × 10)

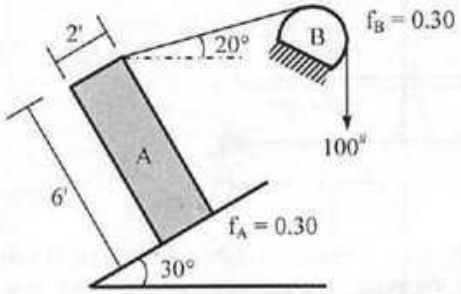
[Answer **any 10 (ten)** of the following 14 questions]

1. The weights of the blocks A and B are 60 lb and 150 lb respectively. Co-efficient of static friction between all the contacting surfaces is 0.10.

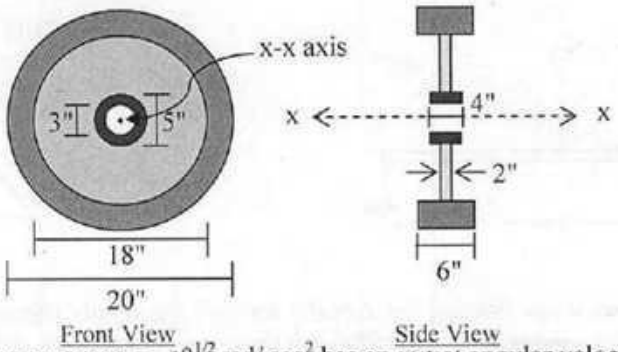
   What is the largest force **F** that can be applied without causing the blocks to slip?



2. In the figure shown below, determine the maximum weight of the block A for which it will turn over.



3. Determine the moment of inertia of the flywheel (shown in the figures below) about the x-x axis.



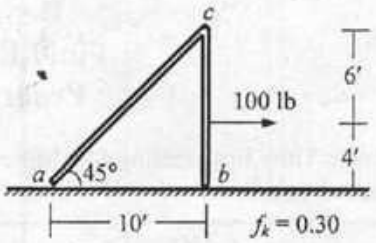
Front View | Side View

4. A rotating wheel follows the equation $\alpha = -4\theta^{1/2}$ rad/ sec^2 has an initial angular velocity of 50 rad/sec. After 7 revolutions, what are the tangential and normal acceleration of a point whose distance from wheel center is 18 in?

5. The mass of the block B in figure shown in Question no. 1 is 150 lb. Co-efficient of static friction between all the contacting surfaces is 0.1. If the block A will slide down the plane from rest at an acceleration of 0.2 fps, what will be the weight of the block A?

6. A 100 lb force is applied horizontally on the frame *abc* (weighing $W = 100$ lb) shown in the figure below, and moved over a floor with friction factor $f_k = 0.30$.

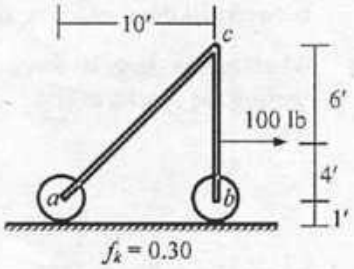
Calculate the
(i) acceleration of the frame
(ii) reaction at *a* and *b*.



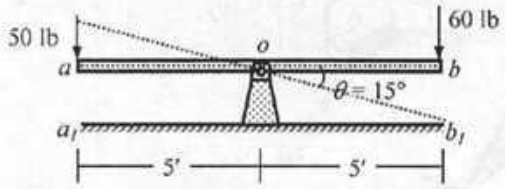
7. A 100 lb force is applied horizontally on the frame *abc* (weighing $W = 100$ lb) shown in the figure below, and moved 10-ft over a floor with friction factor $f_k = 0.30$.

The frame is attached with two 2′-dia wheels (weighing 5 lb each) at *a* and *b*, as shown.

Calculate the
(i) centroidal velocity of the frame
(ii) rotational velocity of the wheels.

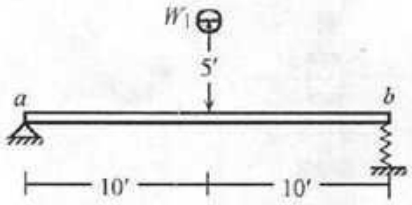


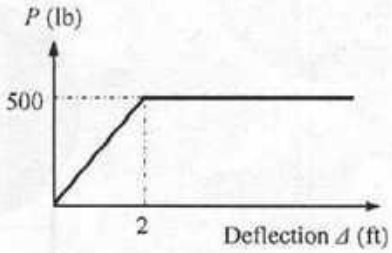
8. Figure below shows a 10-ft long slender rod *aob* (weighing 50 lb) being used as a see saw, applying 50 lb and 60 lb forces at *a* and *b* respectively. Calculate its rotational velocity
(i) after traveling an angular distance $\theta = 15°$ from the initial position *aob*
(ii) at the position *aob* after rebounding from b_1 with an initial angular velocity of 1 rad/sec.



9. Figure below shows weight W_1 falling from a height 5 ft on a rigid slender rod (weighing $W_2 = 10$ lb), which is supported on hinge support at *a* and spring at *b*. The load-deflection (P-Δ) curve of the spring is also shown.

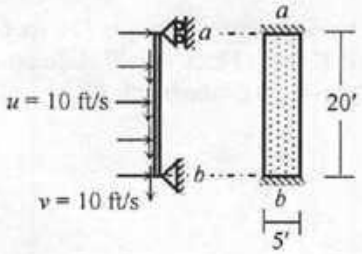
Calculate the weight W_1 required to deflect the spring by an amount Δ = (i) 2 ft, (ii) 3 ft.



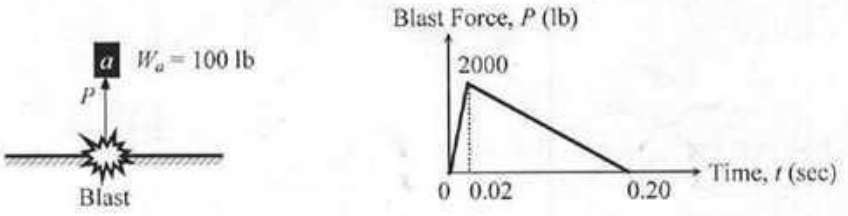


10. Figure below shows water flowing horizontally towards the simply supported wall *ab* with a velocity of $u = 10$ ft/s and moving over it vertically with the same velocity (i.e., $v = 10$ ft/s).

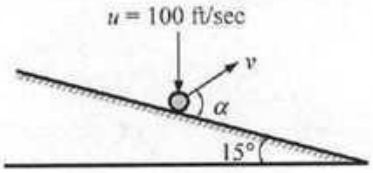
Calculate the magnitude and direction of the resultant force on the beam and reactions at supports *a* and *b* [Given: Unit weight of water = 62.5 lb/ft^3].



11. The object a is subjected to a vertical blast force P, whose variation with time is shown below. If it was initially at rest, calculate
    (i) when it will start moving (i.e., when P will overcome its weight)
    (ii) its velocity when $t = 0.02$ and 0.20 second
    (iii) the maximum height reached by a after the blast force stops acting (i.e., after 0.20 second).

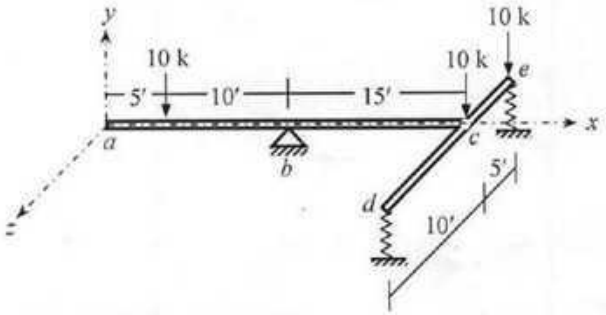


12. A cricket ball hits a 15° inclined surface vertically with a velocity of $u = 100$ ft/sec and rebounds with a velocity v.

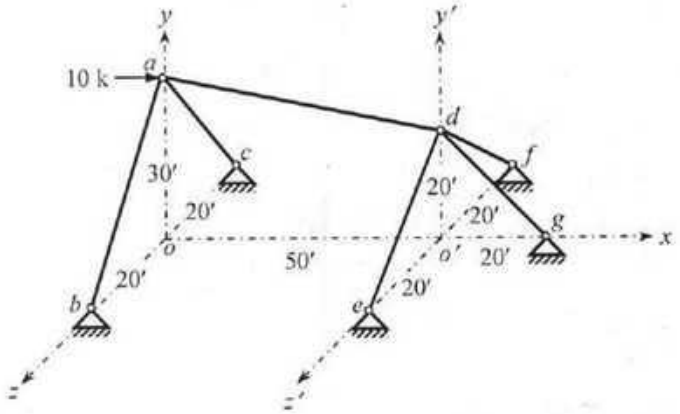


    Calculate the
    (i) magnitude of rebound velocity (v) of the ball and angle (α) it makes with the inclined surface after impact
    (ii) loss of energy of the ball due to the impact.

13. The figure below shows a rigid horizontal grid *abcde* (assumed weightless) with a hinge support b and springs at d and e. Calculate the
    (i) reactions at the support and the springs,
    (ii) vertical deflections at d, e and c [Given: Spring stiffness $k_d = k_e = 100$ k/ft].



14. In the 3D truss loaded as shown below, determine the forces in members
    (i) *ab*, *ac* and *ad*
    (ii) *de*, *df* and *dg*.



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title: Surveying
Time : 3 Hours

Course Code: CE 105
Full Marks: 100

Answer ANY 5 out of 7 questions

1. (a) The TBM of a location in the site is 20.842 m AOD. A leveling job was conducted by tilting level in four locations. The readings were taken for different steps are (12)
Setup 1 :1.361,2.844,2.018,3.015, Setup 2: 0.8555, 0.611, 1.805
Setup 3 :2.741, 1.711, Setup 4: 2.855,1.362, 2.111, 0.856, 2.015
i) Determine the TBM at the last point of the location using Rise and Fall Method.
ii) Calculate the misclosure error and correct the reduced levels if the TBM of the final location is 20.1 m.

(b) How can you check if a point is within a polygon? Explain with example for both raster and vector maps. (4)

(c) Derive the formula for curvature and refraction error in leveling. (4)

2. (a) Draw the basic diagram of a circular curve and write the names of its basic elements. Also derive the relationships for R,L,T and LC.Draw the basic diagram of a spiral curve and identify its basic elements as well. (8)

(b) Assume that $I = 8^0\ 24'$,the station of PI is 64+27.46, and terrain conditions require the minimum radius permitted by the specifications of say, 2864.79 ft (arc definition). Calculate the PC and PT stationing and the external and middle ordinate distances for this curve. Also compute sub-deflection angles and sub-chords δ_a ,c_a , δ_b and c_b. Calculate the chord c. From that, present the results in tabular form of laying out the curve on the field using deflection angle method. (12)

3. (a) A base line was measured in catenary as shown below, with a tape of nominal length 30m.The tape measured 30.015 m when standardized in catenary at 20^0 C and 5 kgf tension. If the mean reduced level of the base was 30.50 m OD, calculate its true length at mean sea level. Given: weight per unit length of tape = 0.03 kg/m; density of steel = 7690 kg/ m^3, coefficient of expansion = 11×10^{-6} per ^{0} C; E = 210×10^3 N/mm^2; gravitational acceleration g = 9.806 m/s^2; radius of the earth = 6.4×10^6 m. (13)

Bay	*Measured length (m)*	*Temperature (deg-C)*	*Applied tension (kgf)*	*Difference in level (m)*
1	30.050	21.6	5	0.750
2	30.064	21.6	5	0.345
3	30.095	24.0	5	1.420
4	30.047	24.0	5	0.400
5	30.041	24.0	7	-

(b) What are the sources of survey data? Explain with example how data can be stored with topological data structure. (2+5)

4. (a) Station A and B have elevations of 265.69 ft and 311.48 ft respectively. Their corresponding instrument heights are 5 ft and 5.5 ft. AB =133.47 ft. A = 40-35-11 (deg-min-sec), B = 31-28-29, v1= 7-14-21 and v2 = 4-8-12. What is the elevation of the chimney stack? (10)

(b) What are the uses of Aerial Photography? Write the specific features of Aerial Photography and satellite images. (3+3))

(c) What are the common structures of survey data? (4)

5. (a) Coordinates of the corner points of a polygon are A(8.34,591.78), B(517.44,202.94), C (523.41,11.27), D(716.29,694.02) and E(125.72, 847.71). Calculate the area of the polygon. (10)

(b) Explain mathematically how the position of an unknown ground point is obtained by GPS machines. (7)

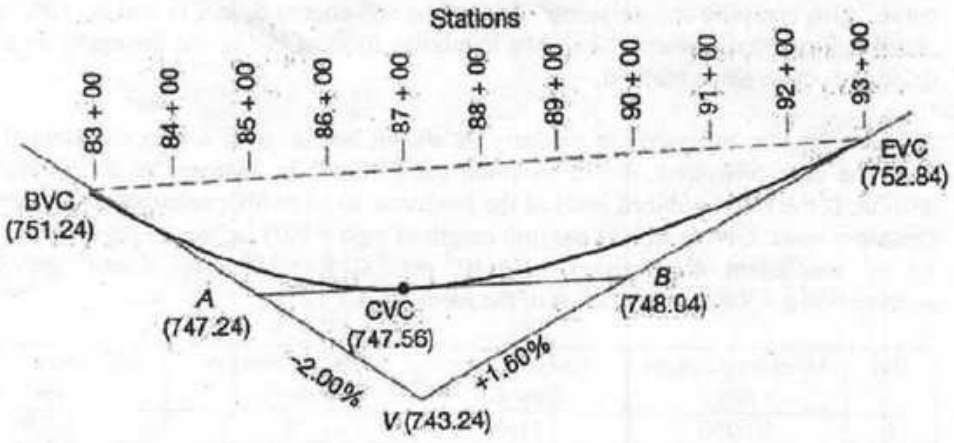
(c) What is GIS? (3)

6. (a) Compute the volume of excavation between station 25+00 with an end area of 711 ft^2 and stations 26+00 with an end area of 515 ft^2. (9)

(b) What is GPS? Briefly describe the different segments of GPS. (2+5)

(c) What are the different sources of error in traversing? (4)

7. (a) For the configuration of figure below, compute and tabulate the notes necessary to stake the unequal-tangent vertical curve at full stations. (15)



(b) Write a short note on Map Projection. (5)

Given formula:

1. $T = R\tan\frac{\Delta}{2}, \quad l = \frac{\pi R\Delta}{180^\circ}, \quad \delta = 1718.9\frac{c}{R}$
2. $O_1 = \frac{c^2}{2R}, \quad O_2 = \frac{C}{2R}(c+C), \quad O_3 = ... = O_{n-1} = \frac{C^2}{R}, \quad O_n = \frac{c'}{2R}(C+c')$
3. $L_{transition} = \frac{v^3}{\alpha R}, \quad \Delta_s = 1719\frac{L}{R}, \quad \Delta_c = \Delta - 2\Delta_s, \quad L_{circular} = \frac{\pi R\Delta_c}{180^\circ}, \quad s = \frac{L^2}{24R}, \quad \tan\theta = \frac{v^2}{gR}$
4. $T = (R+s)\tan\Delta + \frac{L}{2}$
5. $s_h = \frac{f}{H-h}, \quad L = (1-p_l)sl, \quad W = (1-p_w)sw$
6. $a = L \times W, \quad N = \frac{A}{a}$
7. $N_1 = \frac{L_1}{(1-p_l)sl} + 1, \quad N_2 = \frac{L_2}{(1-p_w)sw} + 1$
8. $\tan\alpha_a = \frac{x_a}{f}$
9. $\tan\alpha_b = \frac{x_b}{f}$
10. Level Section $A = (b + nh)\, h$
11. Two-Level Section $A = \{n\,(b/2)^2 + m^2\,(b+nh)h\}/(m^2-n^2)$
12. Three-Level Section $A = \{b\,(h_1+h_2)/4 + h\,(w_1+w_2)/2\}$

    $w_i = m_i n/(m_i - n)\,(h + b/2n)$
    $h_1 = m_1 n/(m_1 - n)\,(h + b/2m_1)$
    $h_2 = m_2 n/(m_2 - n)\,(h - b/2m_2)$
13. $V = \frac{d}{6}(A_1 + A_2 + 4A_m)$

Note: Here the symbols have their usual meanings.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

(13)

Course Title: Surveying
Time : 3 Hours

Course Code: CE 105
Full Marks: 150

*There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". You have to answer from both sections according to the instruction mentioned in each section.*

SECTION A

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

1. (a) What is Interpolation of contours? Discuss any method of Interpolation of contours. (2+7)
   (b) Define (i) Check Line (ii) Tie Line (iii) Main Station. (3)
   (c) An excavation is to be made for a reservoir 20 m long and 14 m wide at the bottom, having side of the excavation slope at 2 horizontal to 1 vertical. Calculate the volume of excavation if the depth is 4 metres. The ground surface is level before excavation. (13)

2. (a) Explain how the procedure of reciprocal leveling eliminates the effects of atmospheric refraction and earth's curvature. (10)
   (b) A camera having focal length of 20 cm is used to take a vertical photograph to a terrain having an average elevation of 1500 m. What is the height above mean sea level at which an aircraft must fly in order to get the photograph at a scale of 1: 7500? (11)
   (c) Define (i) Bench Mark (ii) Datum (iii) Elevation (iv) Turning Point (4)

3. (a) What are the instruments used in chain surveying? (3)
   (b) What detailed instructions would you give to a fresh trainee surveyor regarding the care and use of his field book for recording survey measurements? (6)
   (c) The following consecutive readings were taken with a level (16)
   5.31, 5.92, 6.12, 8.42, 9.81, 6.64, 7.92, 10.21,9.22,7.32,8.45
   The level was shifted after 3rd, 6th and 9th readings. The reduced level at first point was 170 ft. Calculate the reduced levels of the points by using Height of Instrument Method and apply usual arithmetic check.

4. (a) Define (i) Terrestrial Photogrammetry (ii) Aerial Photogrammetry (4)
   (b) A street bend which deflects 70° is to be designed for a maximum speed of 150 km per hour, a maximum centrifugal ratio of 1/5 and a maximum change of acceleration of 35 cm/sec^3, the curve consisting of a circular arc combined with two transition curves. Calculate a) the radius of the circular arc b) length of transition curve c) total length of the composition curve d) the chainage of the beginning and the end of the transition curve and the junctions of the transition curves with the circular arc if the chainage of the P.I is 45000 metres (12)
   (c) Prove, $C = 6/7\ (D^2/2R)$, here the symbols have their usual meanings. (9)

SECTION B

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

5. (a) Derive the relation between the radius and degree of curvature for a simple circular curve by using the arc definition and chord definition of curvature. (8)
   (b) Define (i) Compound curve (ii) Transition curve (2)
   (c) Two tangents intersect at chainage 85+75, the deflection angle being 68° 35′. Calculate the necessary data for setting out a curve of 40 chain radius to connect the two tangents, if it is intended to set out the curve by offset from chords. Consider peg interval equals to 100 links, length of the chain being equal to 20 m (100 links). (15)

6. (a) Define (i) Vertical Photograph (ii) Oblique Photograph (iii) Tilted Photograph (iv) Flying height (v) Flight Line. (10)
   (b) An aircraft has been planned to fly over a defined territory to prepare a map of that area. The territory covers an area of 12.5 km x 14.5 km. The scale of the photograph is 1 cm = 300 m. The photograph size is 18 cm x 18 cm. Determine the number of photographs to cover the area, if the desired overlap is 65% and the side lap is 30%. (15)

7. (a) Define (i) Celestial Poles and Celestial Equator (ii) Celestial Horizon (iii) Zenith and Nadir. Draw necessary sketches. (10)
   (b) Find the distance between two places P and Q along the parallel of latitude, given that latitudes of P and Q are 29° 0′ N and their longitudes are 110° 0′ E and 131° 27′ W respectively. (15)

8. (a) What is GPS? Briefly describe different segments of GPS. (2+10)
   (b) Compute the traverse area by the coordinate method for the following points A(523.41,0), B(716.29,694.02),C(125.72,847.71), D(0,591.78), E(517.44,202.94) (13)

Given formula:

1. $T = R\tan\frac{\Delta}{2}$, $l = \frac{\pi R\Delta}{180^\circ}$, $\delta = 1718.9\frac{c}{R}$
2. $O_1 = \frac{c^2}{2R}$, $O_2 = \frac{C}{2R}(c+C)$, $O_3 = ... = O_{n-1} = \frac{C^2}{R}$, $O_n = \frac{c'}{2R}(C+c')$
3. $L_{transition} = \frac{v^3}{\alpha R}$, $\Delta_s = 1719\frac{L}{R}$, $\Delta_c = \Delta - 2\Delta_s$, $L_{circular} = \frac{\pi R\Delta_c}{180^\circ}$, $s = \frac{L^2}{24R}$, $\tan\theta = \frac{v^2}{gR}$
4. $T = (R+s)\tan\Delta + \frac{L}{2}$
5. $s_h = \frac{f}{H-h}$, $L = (1-p_l)sl$, $W = (1-p_w)sw$
6. $a = L\times W$, $N = \frac{A}{a}$
7. $N_1 = \frac{L_1}{(1-p_l)sl} + 1$, $N_2 = \frac{L_2}{(1-p_w)sw} + 1$
8. $\tan\alpha_a = \frac{x_a}{f}$
9. $\tan\alpha_b = \frac{x_b}{f}$
10. Level Section $A = (b + nh)\, h$
11. Two-Level Section $A = \{n\,(b/2)^2 + m^2\,(b+nh)h\}/(m^2-n^2)$
12. Three-Level Section $A = \{b\,(h_1+h_2)/4 + h\,(w_1+w_2)/2\}$

    $w_i = m_i n/(m_i-n)\,(h+b/2n)$
    $h_1 = m_1 n/(m_1-n)\,(h+b/2m_1)$
    $h_2 = m_2 n/(m_2-n)\,(h-b/2m_2)$
13. $V = \frac{d}{6}(A_1 + A_2 + 4A_m)$

Note: Here the symbols have their usual meanings.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2012
Program: B.Sc Engineering (Civil)

Course #: **CE 107 (A)** Course Title: Introduction to Civil and Environmental Engg.
Full Marks: 100 Time: 2.0 hours

SECTION- I

Answer any **THREE** questions:

1. A. What is Global Warming? What are the main factors considered to determine the temperature?
   B. What is Greenhouse Effect? What are the greenhouse gasses?
   C. How Photochemical Smog develops. (4+2+4)
2. A. What is Acid Rain? What are the effects of acid rain? (4+6)
   B. Draw the idealize diagram of acid rain formation and path.
3. A. Describe the sources of Air Pollution. (5+5)
   B. what are the types of air pollutants? Write short note about any one pollutant.
4. Briefly discuss the important urban environmental issues in Bangladesh. Define renewable and non-renewable energy with examples. (10)

SECTION- II

Answer any **SIX** questions including **QUESTION NO. 1**:

1. A five-storied residential building is to be constructed. Estimate the total construction cost as per the following particulars and specifications of the building. Use PWD schedule and other relevant information provided in the attached appendix. (20)

Sl No	Particulars	Specification
01	Land Size	20m x 30m
02	Building type	Residential (Standard)
03	Allowable Bearing Capacity (q_a)	2 ksf
04	Floor Level	Five
05	Plinth Area	300 Square meter
06	Construction Material	19-21 MPa, RCC Structure 1:1.5:3 (Brick Chips)
07	Ground Floor	Car Parking
08	Roof top RCC water tank including beams and supports etc	2000 Gallons
09	Structure type	RCC Frame Structure
10	Underground water reservoir, distribution line, water pump, pump house, WASA charge	6000 gallons
11	Boundary wall	RCC frame

2. Discuss, in brief, on science, engineering and technology. (10)
3. A. Mention some (six) very important roles of civil engineers in the development of infrastructure.
   B. What are the major foci of any civil engineering project? (8+2)
4. A. Define civil engineering according to ASCE. Mention few names of infrastructures that civil engineers are generally involved in developing.
   B. What are the major sub-disciplines of civil engineering? Mention the names of some other sub-disciplines that are always inevitably participatory in any civil engineering project. (6+ 4)
5. A. Discuss, in brief, "civil engineering" as a career.
   B. Give the names in details of the folloing codes with their related fields.
      (i) BNBC (ii) ASTM (iii) ACI (iv) AASHTO
   C. Categorize building based on type of occupancy. (5+ 2+3)
6. A. Categorize building/construction materials based on specific property of material. What are the major factors for choice of materials?
   B. Mention (names only) few types of loads to be considered in design.
   C. Mention (names only) major components of a building. (4+2+4)
7. A. What is plane surveying and geodetic surveying?
   B. Classify surveying based on object of survey and instruments used.
   C. Mention few names of instruments used in survey work. (3+5+2)
8. For the following conditions, find the total floor area and the number of stories that can be built for a residential building. (10)
   a. Plot size: 15 m x 20 m
   b. Road width = 6 m
   c. FAR = 3.5
   d. MGC = 62.5%
   e. Minimum back setback: 2.0 m
   f. Minimum side setback: 1.25 m

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2012
Program: B.Sc Engineering (Civil)

Course #: **CE 107 (B)** Course Title: Introduction to Civil and Environmental Engg.
Full Marks: 100 Time: 2.0 hours

SECTION- I

Answer any **SEVEN** questions including **QUESTION NO. 1**:

1. Describe the following (any three): (10)
   a. Meteorological and hydrological drought.
   b. Values knowledge and social justice as an environmental issue.
   c. Ecosystem and Bio-diversity.
   d. Age Structure with figure.
2. Define water pollution? Write any four different categories of water pollutant along with their sources and impact. (10)
3. Assume that a population follows a simple logistic growth curve. Find the maximum sustainable yield as a function of carrying capacity, the current population size and current growth rate. (10)
4. A. What is Acid Rain? What are the effects of acid rain? (4+6)
   B. Draw the idealize diagram of acid rain formation and path.
5. A. Describe the sources of Air Pollution.
   B. what are the types of air pollutants? Write short note about any one pollutant. (5+5)
6. Describe different uses OR issues of water. (10)
7. Describe basic environmental issues. (10)
8. A. What is Global Warming? What are the main factors considered to determine the temperature?
   B. What is Greenhouse Effect? What are the greenhouse gasses?
   C. How Photochemical Smog develops? (4+2+4)
9. A. Population of a city was 30 million at a time and after 20 years, population of that city was supposed to be 50 million with a growth rate of 2.55%. But, after 20 years actually population reached at 42 million, so what was the growth rate? (5)

   B. Prove that the time required for population to be double is 70/r, where r is the growth rate expressed in percentage. Population of a country was 100 million in 1990, when will it reach 160 million if it doubles in 2050? (5)

SECTION- II

Answer any **THREE** questions including **QUESTION NO. 1**:

1. For the following conditions, find the total floor area and the number of stories that can be built for a residential building. (10)
   a. Plot size: 15 m x 20 m
   b. Road width = 6 m
   c. FAR = 3.5
   d. MGC = 62.5%
   e. Minimum back setback: 2.0 m
   f. Minimum side setback: 1.25 m
2. A. Mention some (six) very important roles of civil engineers in the development of infrastructure.
   B. What are the major foci of any civil engineering project? (8+2)
3. A. Define civil engineering according to ASCE. Mention few names of infrastructures that civil engineers are generally involved in developing.
   B. What are the major sub-disciplines of civil engineering? Mention the names of some other sub-disciplines that are always inevitably participatory in any civil engineering project. (6+ 4)
4. A. Categorize building/construction materials based on specific property of material. What are the major factors for choice of materials?
   B. Mention (names only) few types of loads to be considered in design.
   C. Mention (names only) major components of a building. (4+2+4)
5. A. What is plane surveying and geodetic surveying?
   B. Classify surveying based on object of survey and instruments used.
   C. Mention few names of instruments used in survey work. (3+5+2)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Materials — Course Code: CE 201
Time: 3 Hours — Full Marks: 150

There are EIGHT Questions. Answer **SIX QUESTIONS including Question No. 1 and Question No. 2. QUESTIONS 1 & 2 are COMPULSORY.**

1 Concrete mix design is required for mat foundation (thickness = 54 inch) of UAP City Campus project at Firmgate based on the following data: (40)

Volume ratio of sand to total aggregate = 0.40
Air Content = 1.5 % (air-entraining admixture is not used)
Specific gravity of cement = 2.95 (CEM Type II/B-M)
Specific gravity of sand (SSD) = 2.6
Specific gravity of coarse aggregate (SSD) = 2.65
Design compressive strength (28 days) = 4000 psi
Minimum required slump = 175 mm
Maximum aggregate size = ¾ inch, Aggregate type = Stone chips
Dosage of superplasticizer = 6 ml/kg of cement if W/C is less than 0.5.

The following graphs are provided :

- Variation of compressive strength (28 days) with W/C,
- Variation of cement content with compressive strength (28 days) for different aggregate size and slump value.

Answer the following:

(i) Prepare a trial mix of concrete based on the given data,
(ii) Calculate the unit weight of the proposed trial mix,
(iii) Prepare a mixture proportion table of the proposed trial mix,
(iv) Calculate the compaction factor of the mix,
(v) Calculate the volume ratio of the mix. Assume unit weights of cement, sand (SSD), and coarse aggregate (SSD) with void are 1375 kg/m^3, 1350 kg/m^3 and 1350 kg/m^3, respectively,
(vi) Calculate unit cost of concrete based on the current unit rates of materials,
(vii) Estimate the materials in weight and volume (cement, water, sand, and coarse aggregate) required to make a segment of the mat of 100 ft long and 100 ft wide,
(viii) Assume 2% surplus water in sand over SSD condition and the amount of bulking of sand is 15%. Make proper adjustment of the proposed mix,
(ix) Compare the absolute volume of the ingredients in the mix and make comments, and
(x) Compare the weight of the ingredients in the mix and make comments.

2 For a bridge construction project, the recommended FMs are 2.6 for sand and 6.6 for stone chips. From a nearby market, sand and stone chips samples were collected and sent to the Concrete Laboratory of University of Asia Pacific (UAP) for sieve analysis. The sieve analysis data are given below: (22)

ASTM Sieve	Amount Retained (g)	
	Sand	Stone Chips
3 inch	0	0
1.5 inch	0	0
1.06 inch	0	0
¾ inch	0	0
1/2 inch	0	4000
3/8 inch	0	500
#4	0	450
#8	140	0
#12	70	0
#16	70	0
#30	70	0
#40	5	0
#50	5	0
#100	5	0
#200	40	0
Pan	45	50

Answer the following:

(i) Calculate FM of the samples (sand and stone chips),
(ii) Draw grading curves of the samples,
(iii) Discuss the possible ways to improve the FM of the samples to the recommended values,
(iv) Comment on the samples based on the sieve analysis data and grading curves, and
(v) From other source, another sand sample was collected and FM was found to be 2.2. In what proportions, the sand samples are to be mixed to achieve the required FM of sand?

Sieve openings for different sieves are provided (refer to the attached table).

3 (a) Draw typical stress-strain curves of concrete with the change of compressive strength. Explain the remarkable changes in mechanical properties of concrete with the change of compressive strength. (2.5)

(b) Define initial tangent modulus, secant modulus, and tangent modulus. How do you determine Young's modulus from a stress-strain curve of concrete? (2.5)

(c) Define the following mechanical properties of a material: (3)

(i) Toughness,
(ii) Ductility, and
(iii) Fatigue strength.

(d) Write a short note on the worldwide consumption of concrete and its ingredients. How are concrete industries polluting our environment? (3)

(e) Why is drying of raw brick necessary before burning? What is the preferable (3)

moisture content in raw brick before burning?

(f) What is a pug mill? How do you check the consistency of brick earth before moulding? (3)

(g) Write the functions of frog mark on brick. (2)

(h) What is efflorescence? Explain the effect of efflorescence of bricks on the quality of construction works. (3)

4 (a) Draw a flow diagram of manufacturing of cement in an integrated plant. Discuss the process of grinding clinker in a ball mill (based on your experience on a visit to Seven Rings Cement factory at Gazipur). (5)

(b) What do you mean by hydration of cement? Write the hydration reactions of cement and discuss the morphology of the hydration product. (4)

(c) Compare fly ash cement and OPC with respect to the following: (5)

(i) Heat of hydration,
(ii) Early strength,
(iii) Long-term strength,
(iv) Workability of fresh concrete, and
(v) Microstructure of hardened concrete.

(d) Discuss the effect of fineness of cement on the following: (3)

i) Compressive strength of concrete at the early age,
ii) Compressive strength of concrete after a long term,
iii) Heat of hydration of cement,
iv) Micro cracking in concrete,
v) Durability of concrete, and
vi) Cost of cement.

(e) Mention the common type of cements that are used in Bangladesh with their composition. (3)

(f) Compare initial setting time and final setting time of cement. (2)

5 (a) Discuss sulfate attack of concrete with chemical reactions. Write the possible measures that you can suggest against sulfate attack of concrete. (5)

(b) What are the main causes of early deterioration of concrete structures in Bangladesh? (5)

(c) Define workability of concrete. How is it measured? Discuss the effect of the following factors on workability of concrete: (4)

i) Shape of the aggregate,
ii) Cement content,
iii) W/C, and
iv) Fineness modulus of sand.

(d) Discuss the effect of W/C ratio on compressive strength, permeability, and durability of concrete. (4)

(e) Compare entrained air and entrapped air in concrete. What is the purpose of using air entraining admixture in concrete? Is it necessary to use air entraining admixture in Bangladesh for general construction works? (4)

6 (a) Discuss the influence of the following factors on compressive strength of concrete: (5)

(i) Sand to aggregate volume ratio,
(ii) Size of coarse aggregate,
(iii) Shape of coarse aggregate,
(iv) Compaction, and

(v) Curing.

(b) "Cube strength of concrete is higher than the cylinder strength of concrete" – Why? (2)

(c) Write short notes on the following: (6)
(i) High performance concrete,
(ii) Ferrocement,
(iii) Maturity of concrete,
(iv) Setting and hardening of cement,
(v) Normal consistency of cement, and
(vi) FRP.

(d) Write short notes on the following: (5)
(i) Alkali silica reaction,
(ii) Workability of concrete,
(iii) Chloride threshold level,
(iv) Segregation, and
(v) Plastic shrinkage.

(e) Discuss the possible measures against concrete construction works in a hot environment. (2)

(f) "High strength concrete is susceptible to autogeneous shrinkage" – Why? What measures are to be taken against it? (2)

7 (a) What is carbonation of concrete? Discuss with chemical reaction. How does carbonation cause corrosion of steel bar inside concrete? (3)

(b) Discuss corrosion of steel in concrete with anodic and cathodic reactions. (5)

(c) What is cathodic protection? Compare cathodic protection applied by impressed current system and discrete anode system. (3)

(d) Write short notes on the following: (6)
i) Formation of annual rings of a tree,
ii) Use of plastics in Civil Engineering works,
iii) Crystal structure and amorphous structure, and
~~iv) Maturity of concrete.~~

(e) "Fly ash shows pozzonanic activity but slag shows hydraulic activity" – Why? (2)

(f) Discuss the empirical relationships for the following: (3)
i) Compressive strength and tensile strength of concrete, and
ii) Compressive strength and Young's modulus of concrete.

8 (a) Explain three different defects of timber. (3)

(b) Explain three industrial forms of timber. (3)

(c) What are the objectives of seasoning of timber? (2)

(d) Write short notes on the following: (9)
(i) Use of rubber in Civil Engineering works,
(ii) Atomic packing factor for the face centered cubic unit cell,
(iii) Ingredients of paints,
(iv) Metallic coating,
(v) Vulcanization, and
(vi) Hexagonal close packed unit cell.

(e) What is bulking of sand? Explain briefly. (2)

(f) Draw stress-strain curves for rubber, copper, and steel and explain their behavior. (3)

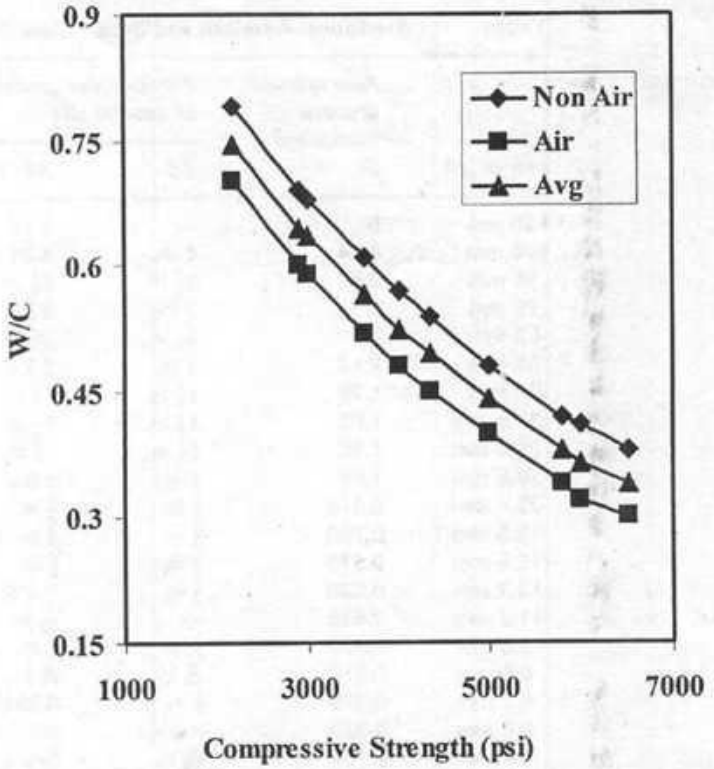


Fig. W/C versus Compressive Strength (aggregate type = stone chips)

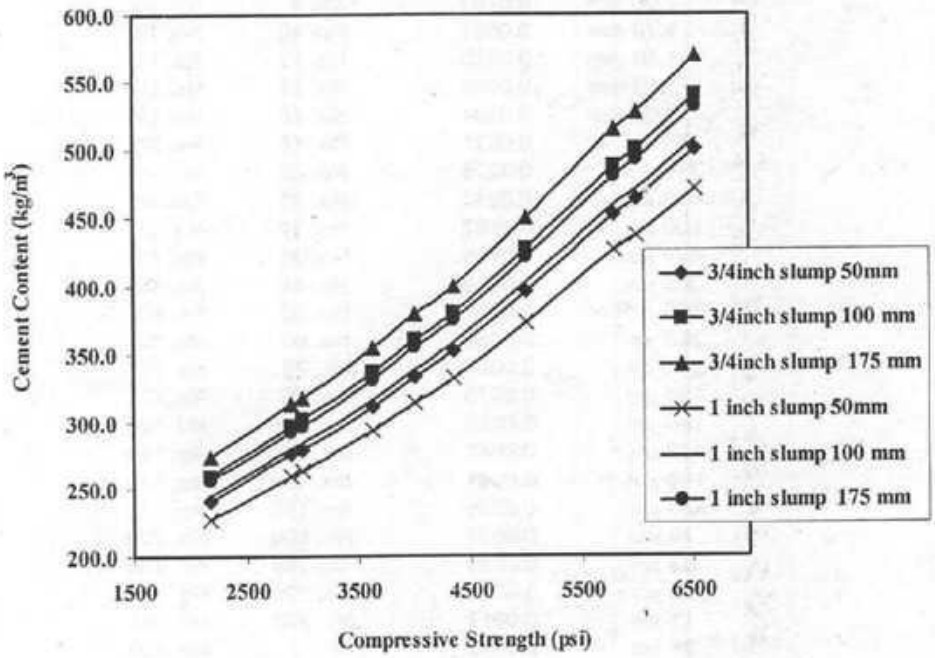


Fig. Cement Content versus Compressive Strength (aggregate type = stone chips)

Table Traditional American and British Sieve Sizes

Aperture mm or μm	*Approximate Imperial equivalent in.*	*Previous designation of nearest size*	
		BS	*ASTM*
125 mm	5	—	5 in.
106 mm	4.24	4 in.	4.24 in.
90 mm	3.5	$3\frac{1}{2}$ in.	$3\frac{1}{2}$ in.
75 mm	3	3 in.	3 in.
63 mm	2.5	$2\frac{1}{2}$ in.	$2\frac{1}{2}$ in.
53 mm	2.12	2 in.	2.12
45 mm	1.75	$1\frac{3}{4}$ in.	$1\frac{3}{4}$ in.
37.5 mm	1.50	$1\frac{1}{2}$ in.	$1\frac{1}{2}$ in.
31.5 mm	1.25	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.
26.5 mm	1.06	1 in.	1.06
22.4 mm	0.875	$\frac{7}{8}$ in.	$\frac{7}{8}$ in.
19.0 mm	0.750	$\frac{3}{4}$ in.	$\frac{3}{4}$ in.
16.0 mm	0.625	$\frac{5}{8}$ in.	$\frac{5}{8}$ in.
13.2 mm	0.530	$\frac{1}{2}$ in.	0.530 in.
11.2 mm	0.438	—	$\frac{7}{16}$ in.
9.5 mm	0.375	$\frac{3}{8}$ in.	$\frac{3}{8}$ in.
8.0 mm	0.312	$\frac{5}{16}$ in.	$\frac{5}{16}$ in.
6.7 mm	0.265	$\frac{1}{4}$ in.	0.265 in.
5.6 mm	0.223	—	No. $3\frac{1}{2}$
4.75 mm	0.187	$\frac{3}{16}$ in.	No. 4
4.00 mm	0.157	—	No. 5
3.35 mm	0.132	No. 5	No. 6
2.80 mm	0.111	No. 6	No. 7
2.36 mm	0.0937	No. 7	No. 8
2.00 mm	0.0787	No. 8	No. 10
1.70 mm	0.0661	No. 10	No. 12
1.40 mm	0.0555	No. 12	No. 14
1.18 mm	0.0469	No. 14	No. 16
1.00 mm	0.0394	No. 16	No. 18
850 μm	0.0331	No. 18	No. 20
710 μm	0.0278	No. 22	No. 25
600 μm	0.0234	No. 25	No. 30
500 μm	0.0197	No. 30	No. 35
425 μm	0.0165	No. 36	No. 40
355 μm	0.0139	No. 44	No. 45
300 μm	0.0117	No. 52	No. 50
250 μm	0.0098	No. 60	No. 60
212 μm	0.0083	No. 72	No. 70
180 μm	0.0070	No. 85	No. 80
150 μm	0.0059	No. 100	No. 100
125 μm	0.0049	No. 120	No. 120
106 μm	0.0041	No. 150	No. 140
90 μm	0.0035	No. 170	No. 170
75 μm	0.0029	No. 200	No. 200
63 μm	0.0025	No. 240	No. 230
53 μm	0.0021	No. 300	No. 270
45 μm	0.0017	No. 350	No. 325
38 μm	0.0015	—	No. 400
32 μm	0.0012	—	No. 450

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course # : CE-203 Course Title: Engineering Geology & Geomorphology
Full Marks: 120 (60 + 60= 120) Time: 3 hours

Section A

There are **four (4)** questions in this section, Answer **any three (3)** **20 x 3 = 60**

1. (a) Describe, in short, different geomorphic processes that change the landform of the earth. 14
(b) Draw a schematic diagram of rock cycle (with one example of each type of rock) in geologic point of view. 6

2. (a) Classify and describe major minerals. Distinguish between Ferromagnesian and Non-Ferromagnesian Silicates. 10
(b) Define folds, fault, joint and rock cleavage. 4
(c) Classify (mention names only) and draw sketches of different types of faults. 6

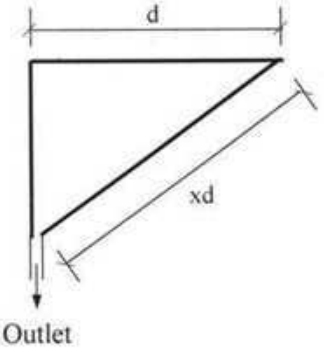
3. (a) Classify and discuss briefly (with neat sketches) various types of folds based on geometry. 8
(b) Discuss on liquefaction phenomenon (with basic mechanism) due to earthquake. 6
(c) Classify and discuss, in short (no sketch is required), various earthquake waves. 6

4. Briefly discuss, mention or draw sketches, as asked for, on **any four** of the following topics:- **5 X 4 = 20**
(i) Principal zones of earth
(ii) Typical geometry of a fold (with neat sketch)
(iii) Neat sketches of Horst and Graben
(iv) Major earthquake parameters (geometric)
(v) Modified Mercalli intensity scale of earthquakes (VIII to XII)

Section B

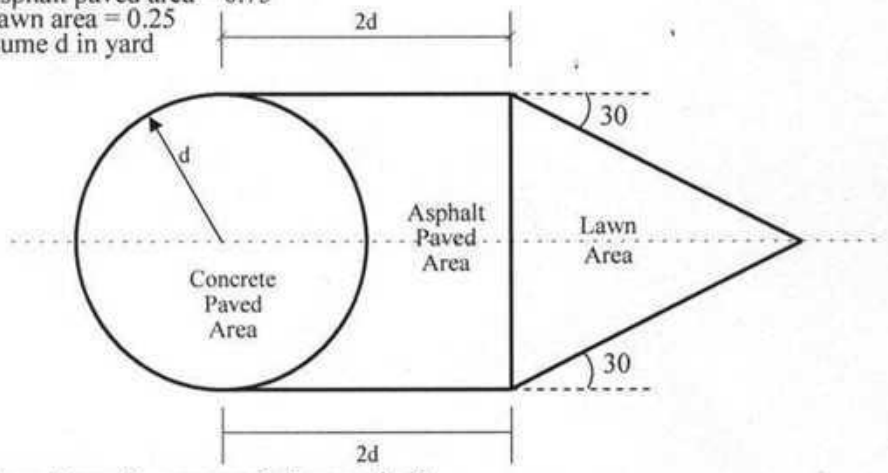
There are **four (4)** questions in this section. Answer **any three (3)** **20 x 3 = 60**

1. (a) Discuss, in brief, the factors affecting runoff. 6
(b) For the following basin, x is a constant factor. For what value of x, the flow rate (Q) will be the maximum for the basin? Find the FF and CC of the basin for maximum runoff. 7



(c) Calculate Peak runoff (Q) for the following facility under the following conditions: 7

- Rainfall Intensity for the whole area = 2.25 in/hr
- Co-efficient of runoff for-----
  Concrete paved area = 0.85
  Asphalt paved area = 0.75
  Lawn area = 0.25
- Assume d in yard

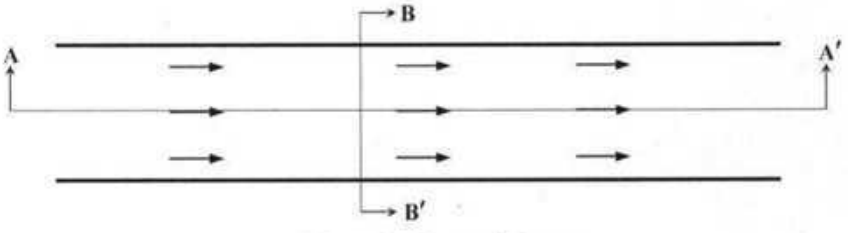


2. (a) What are the major causes of river erosion? 1.5

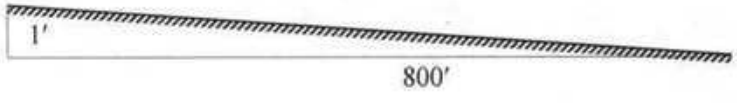
(b) Prove that $H = ae^{-bx}$; where symbols carry their usual meanings. 4

(c) Prove that $d \propto v^2$; where symbols carry their usual meanings. 7.5

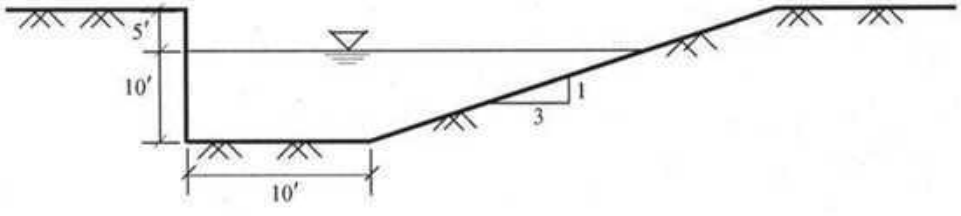
(d) The longitudinal and cross-sectional profiles of a channel are shown. Calculate the unit tractive force along the channel bottom. 7



Plan of a Channel Course



Section A-A′
(Longitudinal Profile)

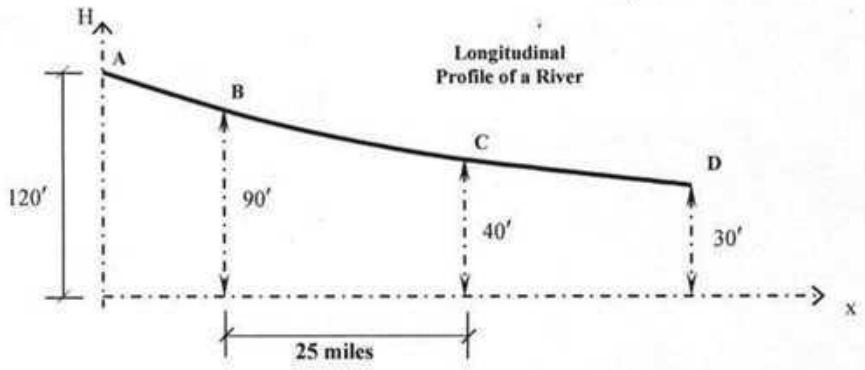


Section B-B′
(Cross-Sectional Profile)

3. (a) Define river transportation, load, capacity and competence. Categorize (mention names only) load of a river. 4

(b) Mention the major factors affecting the longitudinal profile of a river. 2

(c) From the figure shown below, calculate the horizontal distance between locations A and D along the longitudinal profile of a river. 7



(d) The number and stream ranks of a catchment area of 1,125 square miles are calculated and the results of the survey are summarized in the table below. 7

Steam Rank	No. of Streams	Average Length (mile)
1	22	1.3
2	7	2.2
3	3	6.9
4	1	18.2

Calculate the following parameters from the above survey data:
(i) Average Bifurcation Ratio (ABR)
(ii) Average Length Ratio (ALR)
(iii) Drainage Density (DD)
(iv) Stream Frequency

4. (a) Classify and discuss, in brief, different types of drainage patterns. **10**

(b) What is a river valley? Sketch a typical cross-section of a river/stream valley. Classify (mention names only) valley according to the stage, genesis and controlling structures. **4**

(c) Discuss, in brief, different ways valleys are deepened. **6**

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Code: CE 205 Course Title: Numerical Analysis & Computer Programming

Time: 3 hours Credit Hours: 3.0 Full Marks: 90 (= 60+30)

[There are two sections **SECTION A** and **SECTION B.** Answer both the sections]
[All questions carry equal marks]

SECTION A (Numerical Analysis)

[Answer **any 6 (Six)** of the following **8** questions]

1. Use Taylor's method to obtain the numerical solution of the following ordinary differential equation for x = 4 with step-size equal to 2. Given that, y(0)=1.

$$\frac{dx}{dy} = \frac{x+y}{y-x}$$

2. Determine the velocity of a automobile at time, t = 12.9 sec for the following data using Gregory Newton Interpolation Method.

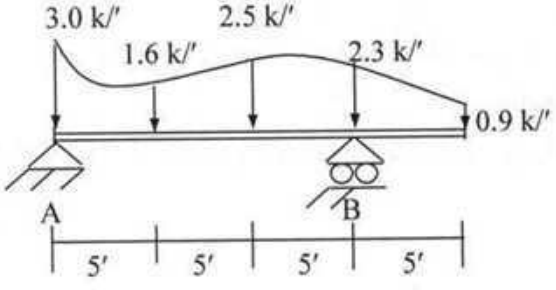
Time (sec)	5	10	15	20
Velocity (mps)	0.0736	0.2849	0.7632	1.5735

3. The non-linear first-order Ordinary Differential Equation (ODE) governing unsteady radion heat transfer per unit time from a mass can be expressed as follows:
$\frac{dT}{dt} = -\alpha (T^4 - T_a^4)$ where, $\alpha = 4x10^{-12}$, $T_a = 250$ K, $T(1) = 2500$ K
Solve the ODE for t = 5 by 4th order Runge-Kutta Method using step-size of 2.

4. The discharge (Q) through a hydraulic structure for different values of head (H) is shown below. Calculate the discharge Q for H = 3.0 ft, using Newton's Divided-Difference Interpolation Method.

H (ft)	1.2	2.1	2.7	4.0
Q (cft/sec)	25	60	90	155

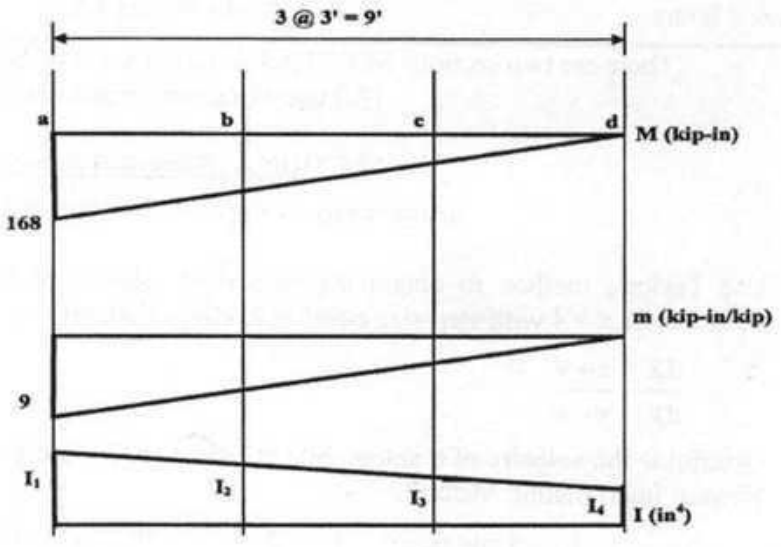
5. For the beam loaded as shown in the figure below, calculate the vertical reaction R_B at support B using ***Simpson's ⅓*** Rule [The summation of moments at A due to R_B and the distributed load equal to zero].



6. Use the least-square method to fit an equation of the form $S = at^{0.3}$ for the data shown below. Using the best-fit equation, calculate S for t = 28 days.

t (days)	3	7	14	21
S (ksi)	1.3	1.8	2.3	2.5

7. The following diagrams show the variation of bending moments ***M*** and ***m*** and moment of inertia ***I*** in a beam. Estimate I_1 (use ***Simpson's ⅜ rule***).
[Given: Deflection of a beam, $\int(Mm/EI)dx = 0.014$ in, and $I_1:I_4 = 4:1$, E=29000 ksi]



8. Given the (x,y) ordinates of four points (0,2.2), (2.1,3.1), (3.2,3.5), (4.6,4.3), fit a general straight line [$y = f(x) = a_0 + a_1 x$], through this set of data points.

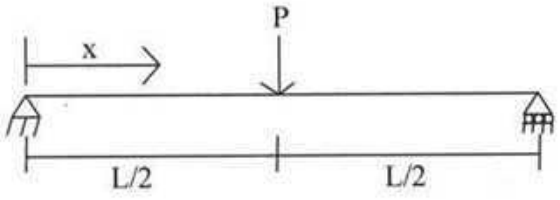
Formula:

1. $P = (x-x_1)(x-x_2)\ldots.(x-x_n)/\{(x_0-x_1)(x_0-x_2)\ldots.(x_0-x_n)\}f(x_0) + (x-x_0)(x-x_2)\ldots.(x-x_n)/\{(x_1-x_0)(x_1-x_2)\ldots.(x_1-x_n)\}f(x_1) + \ldots + (x-x_0)(x-x_2)\ldots.(x-x_{n-1})/\{(x_n-x_0)(x_n-x_1)\ldots.(x_n-x_{n-1})\}f(x_n)$
2. $P = f(x_1) + \{\Delta f(x_1)*u\}/1! + \{\Delta^2 f(x_1)*u*(u-1)\}/2! + \{\Delta^3 f(x_1)*u*(u-1)*(u-2)\}/3! + \ldots\ldots..$
3. $\Delta^n f(x_1) = {}^nc_0\, f(x_1 + n*h) - {}^nc_1\, f\{x_1 + (n-1)*h\} + {}^nc_2\, f\{x_1 + (n-2)*h\} - \ldots.. + {}^nc_n\, f(x_1)$
4. $A = h\,\{(y_0 + y_n)/2 + (y_1 + y_2 + \ldots..+ y_{n-1})\}$
5. $A = (h/3)\,\{y_0 + y_n + 4\,(y_1 + y_3 + \ldots\ldots\ldots\ldots + y_{n-1}) + 2\,(y_2 + y_4 + \ldots\ldots..+ y_{n-2})\}$
6. $A = (3h/8)\,\{y_0 + y_n + 3\,(y_1 + y_2 + y_4 + y_5 + y_7 + \ldots.+ y_{n-1}) + 2\,(y_3 + y_6 + \ldots)\}$
7. $y_1 = y_0 + 1/6\,(k_1 + 2k_2 + 2k_3 + k_4)$
   here $k_1 = hf(x,y)$; $k_2 = hf(x+h/2, y+k_1/2)$; $k_3 = hf(x+h/2, y+k_2/2)$; $k_4 = hf(x+h, y+k_3)$

SECTION B (Computer Programming)

[Answer **any 3 (Three)** of the following **4** questions]

1. Write a program that can display shear and moment values of the simply supported beam shown below at an interval of L/4 [Here L and P are real positive number].



Location (From Left)	SF	BM
$0 \le x < L/2$	P/2	Px/2
$x = L/2$	0	PL/2
$L/2 < x \le L$	-P/2	P(L-x)/2

2. (i) Using *'for'* loop, write a program that can read two separate odd numbers and display the sum of all the odd numbers in between the two.

   (ii) If any of the assigned values is not an odd number, modify the above program in a way that it can alert the user and suggest to reassign that value.

3. Four students took all three theory courses of Mr. X in Spring, 2012. Class test marks of all four students in these courses are shown below. Using array, write a program to determine the maximum and calculate the average value for every student.

	Student 1	Student 2	Student 3	Student 4
CE 205	8.5	6.5	Absent	4
CE 333	7	8	6	6
CE 411	Absent	5	2	9.5

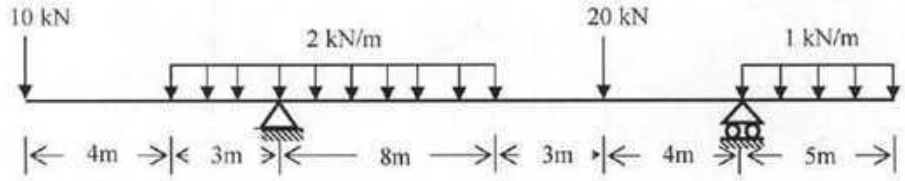
4. Write a program that calculates the real roots of any quadratic equation $ax^2+bx+c=0$ for given values of a, b and c.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012 (Set A)
Program: B. Sc. Engineering (Civil)

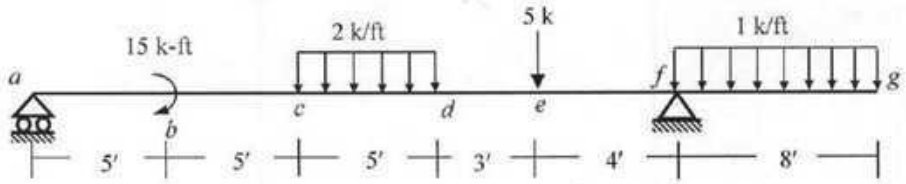
Course Title: Mechanics of Solids I | Course No: CE 211
Time: 3 hours | Full marks: 100 (= 10 × 10)

Answer any **10** of the following **14** questions.

1. Draw the axial force, shear force and bending moment diagrams for the beam shown below.

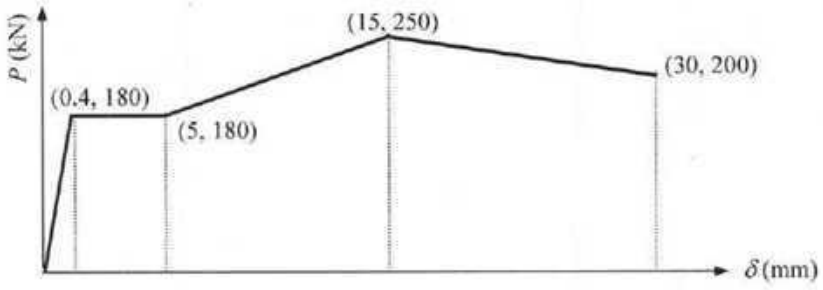


2. For the beam *abcdefg* loaded as shown in the figure below
   (i) Derive the equations for shear force and bending moment using Singularity Functions.
   (ii) Calculate shear force at the left of point *e* and bending moment at the right of point *b*.

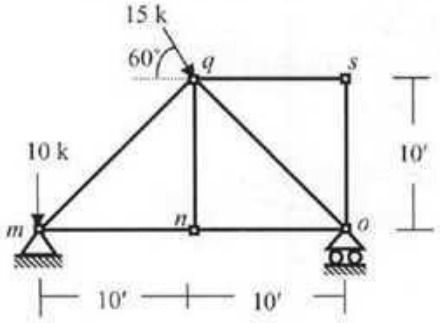


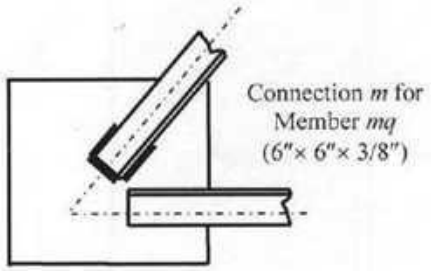
3. Briefly discuss the following terms
   (i) Modulus of Elasticity
   (ii) Modulus of Resilience
   (iii) Yield Strength
   (iv) Ultimate Strength
   (v) Modulus of Toughness.

4. Figure below shows the axial force (P) vs. elongation (δ) diagram of a 180 mm long mild steel specimen of 25 mm diameter. Calculate its
   (i) Young's modulus,
   (ii) Apparent breaking strength,
   (iii) Energy needed to break the specimen,
   (iv) Modulus of Resilience.

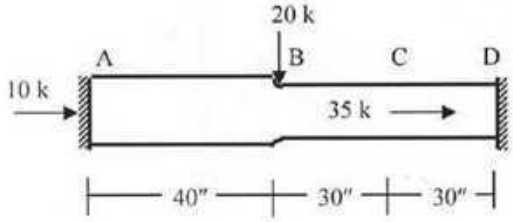


5. For the truss shown below, calculate the lengths of 3/8-inch weld required on three sides to connect the member *mq* to a gusset plate as shown [Given: Allowable shear stress = 16 ksi].



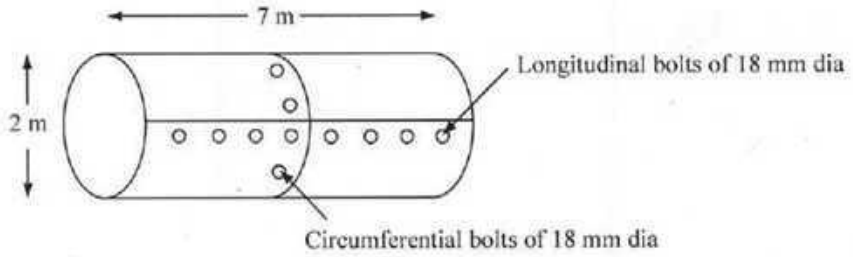


6. Draw the axial force diagram of the statically indeterminate axially loaded bar shown below [Given: E = 3000 ksi, Members AB and BCD are (8" × 3"/8) and (6" × 3"/8) sections respectively].

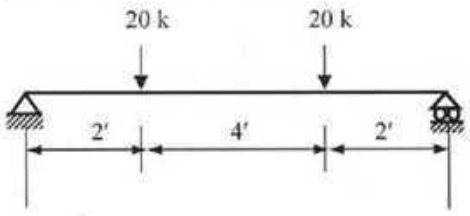


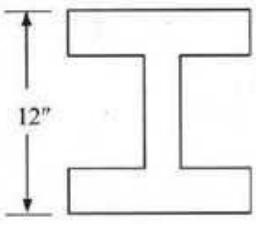
7. For a gas cylinder of 2 m diameter and 5 mm wall thickness, calculate the
   (i) maximum internal pressure that the cylinder can be subjected to
   (ii) corresponding tangential and longitudinal stresses and strains in the wall of the cylinder
   (iii) required spacing of 18 mm diameter bolts (both longitudinal and circumferential) to resist the wall stresses

   [Given: Allowable tensile stress in the wall = 90 MPa, Allowable shear stress in bolts = 80 MPa, Modulus of elasticity = 20 GPa, Poisson's ratio = 0.25].

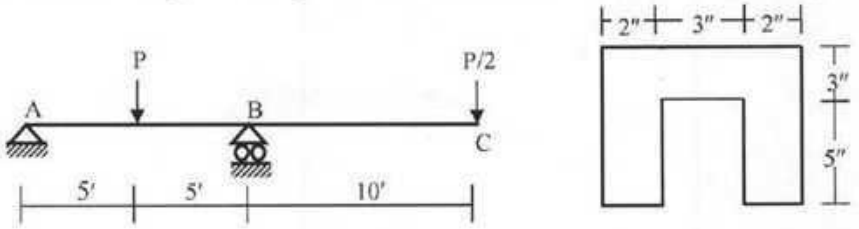


8. The simply supported beam shown below carries symmetrical loads of 20 k each. If the allowable stress in either tension or compression is 20 ksi, calculate the required moment of inertia for the 12" deep symmetrical cross-section.

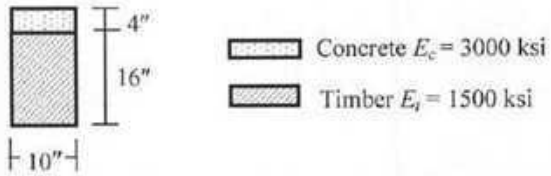




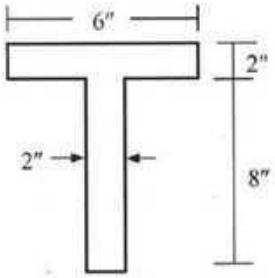
9. For the beam ABC shown below, the allowable tensile and compressive bending stresses in the cross-section are 9 ksi and 5 ksi respectively.
   (i) Calculate the maximum allowable value of the load P.
   (ii) Draw the bending stress diagram over cross-section B for the value of P calculated in (i).



10. For the beam shown in Question No. 9, draw the flexural stress and strain diagrams over the composite cross-section at B when P = 50 k.

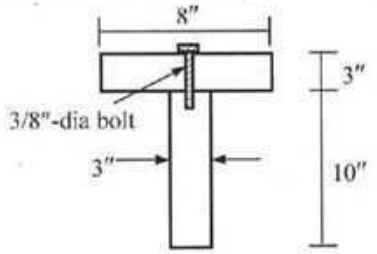


11. Draw the shear stress diagram over the cross-section shown below and locate the position and value of the minimum and maximum stresses, if the applied shear force V= 60 k.

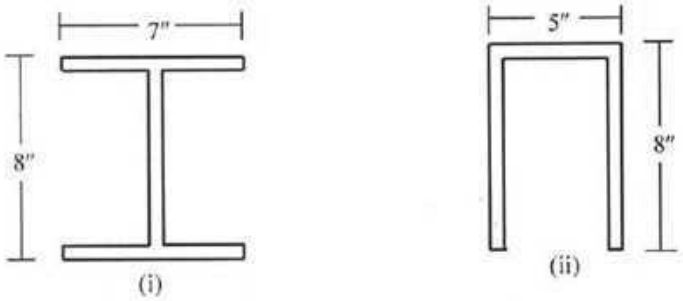


12. For the beam shown in Question No. 9, the allowable flexural shear stress is 55 psi.
   (i) Calculate the maximum allowable value of the load P.
   (ii) Draw the shear stress diagram over cross-section C for the value of P calculated in (i).

13. Calculate the spacing of 3/8" bolts to resist the maximum shear force in the beam shown in Question No. 9 with P = 10 k and cross-section shown below [Given: Allowable shear stress = 12 ksi].



14. Locate shear center of the cross-sections shown below and comment on the results.

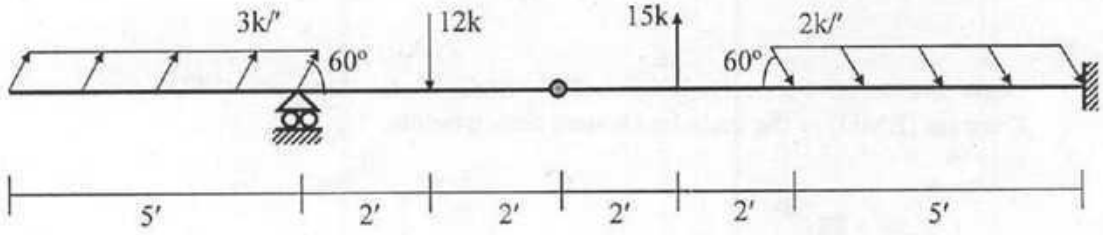


University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

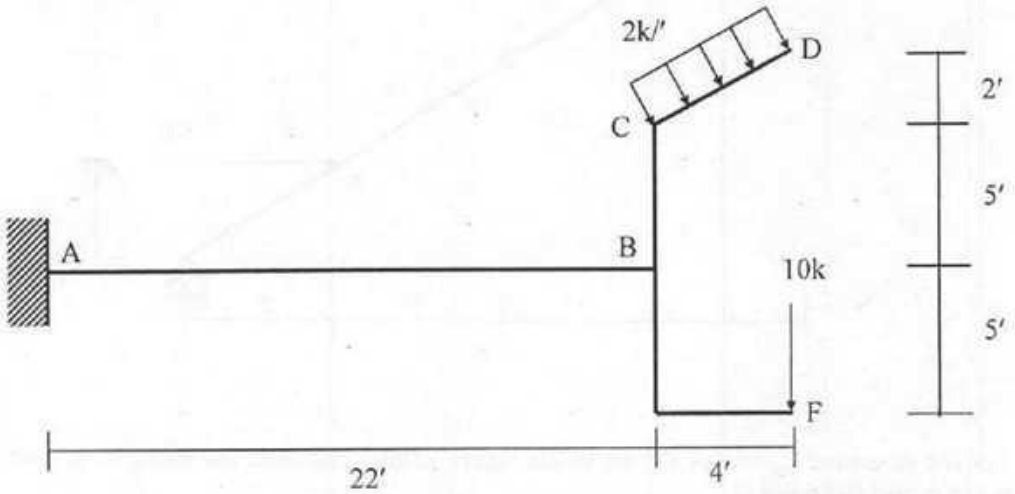
Course Title: Mechanics of Solids I | Course Code: CE 211
Time: 3 hours | Full Marks: 100(= 10 x 10)

[Answer **any 10 (ten)** of the following 14 questions]

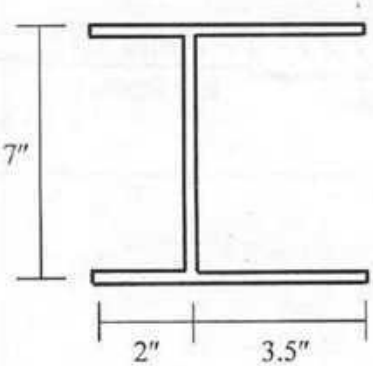
1. Draw the Axial Force Diagram (AFD), Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) of the beam shown below.



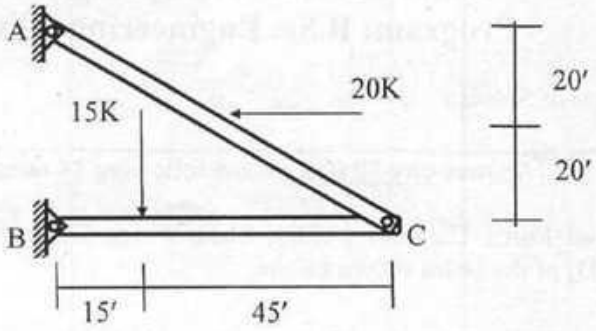
2. Draw the Axial Force Diagram (AFD), Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) of beam AB shown below.



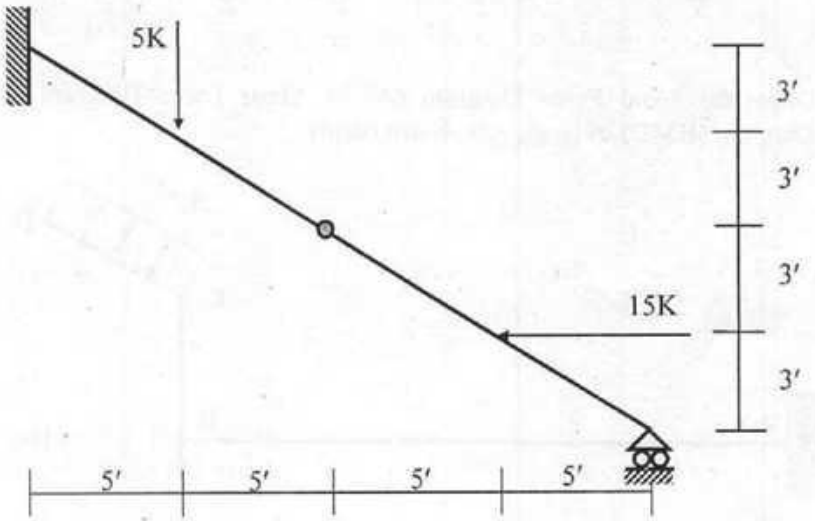
3. Determine the location of shear center of the cross-section shown below. Thickness is 0.1" throughout.



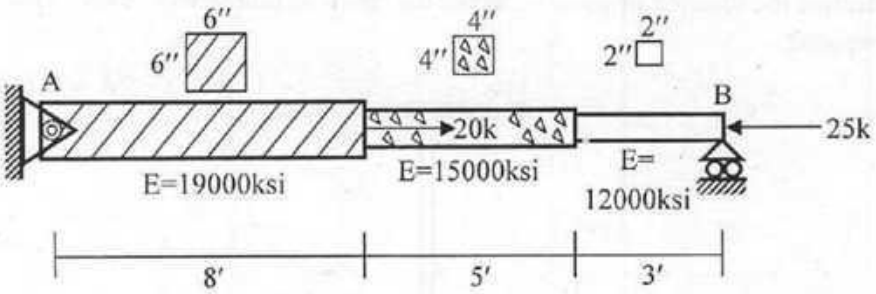
4. Draw the Axial Force Diagram (AFD), Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) of beam BC shown below.



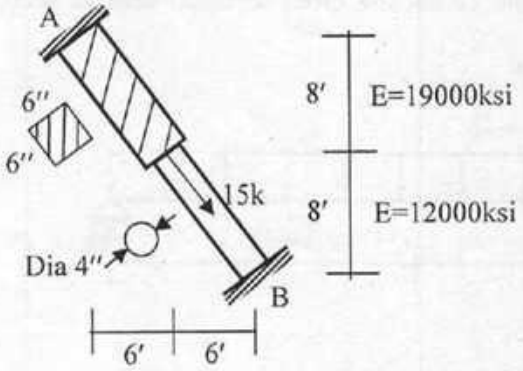
5. Draw the Axial Force Diagram (AFD), Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) of the inclined element shown below.



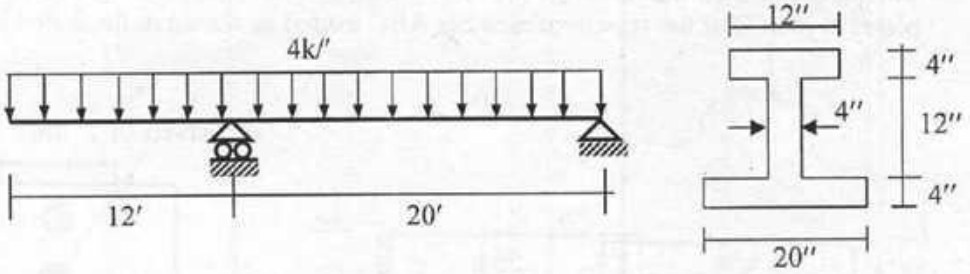
6. For the structure loaded as shown in the figure below, calculate the elongation/contraction of (i) point A and (ii) point B.



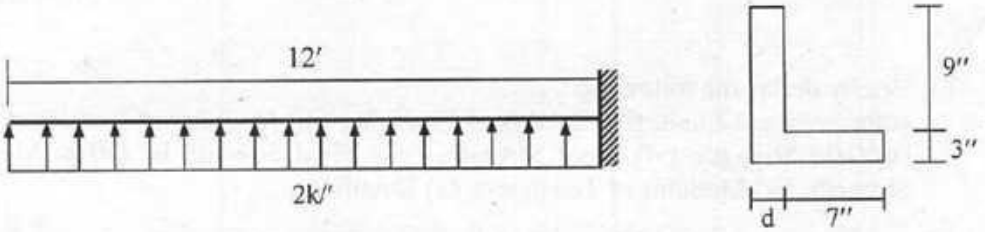
7. Draw the Axial Force Diagram (AFD) of the beam AB shown below.



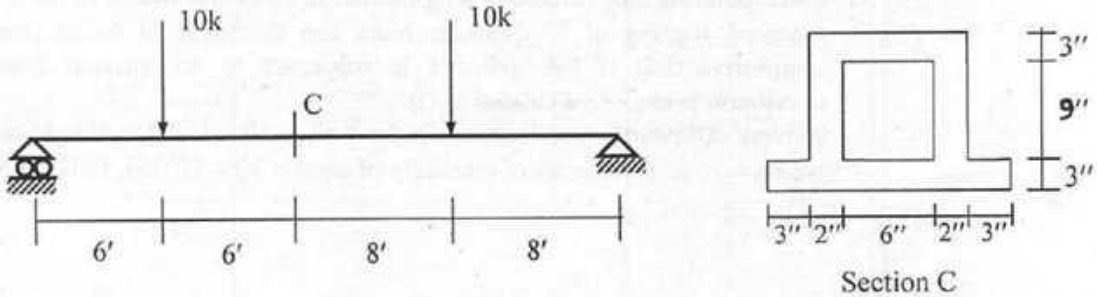
8. For the beam loaded as shown in the figure below, calculate the maximum tensile and compressive stress for bending moment only.



9. For the beam loaded as shown in the figure shown below, calculate the minimum value of the dimension "d" if the maximum allowable tensile and compressive stress for flexure (i.e. bending moment) of the material of the beam is 1000 psi and 8000 psi respectively.

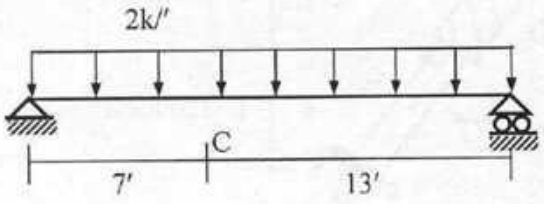


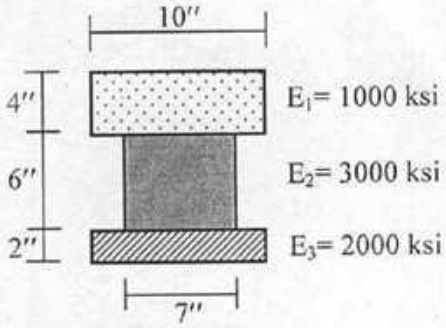
10. For the beam loaded as shown in the figure below, calculate the minimum and maximum value of shear stress across the cross section "c" of the beam, which is 12 feet from the left support.



Section C

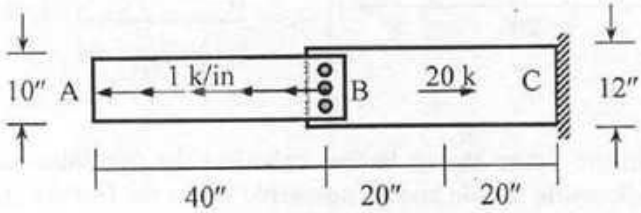
11. For the simply supported beam loaded as shown below, draw the flexural stress and strain diagrams over the composite cross-sectional area at section C which is 7 feet from the left support.



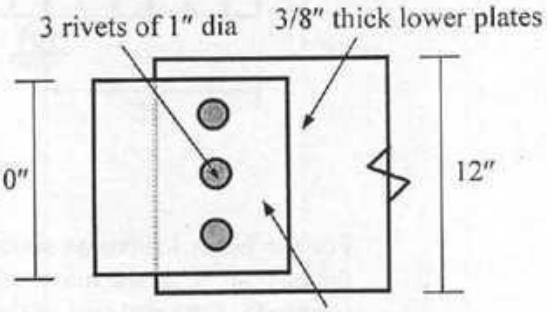


Section C

12. Calculate the shearing stress in the rivets and the maximum tearing and bearing stresses in the plates at joint B of the structural member ABC loaded as shown in the following figure.



Member ABC



Joint B (Lap Joint)

13. Briefly define the following:
(i)Proportional Limit, (ii)Modulus of Elasticity, (iii) Modulus of Resilience, (iv)Poisson's Ratio, (v)Yield Strength, (vi) Proof Strength, (vii) Yield Strength by Offset Method, (viii) Ultimate Strength, (ix) Modulus of Toughness, (x) Ductility.

14. For a gas cylinder of 6′ diameter and 0.25″ wall thickness, calculate the
(i) maximum internal pressure that the cylinder can be subjected to,
(ii) corresponding tangential and longitudinal stresses and strains in the wall of the cylinder,
(iii) required spacing of 1″ diameter bolts and thickness of welds (both longitudinal and circumferential) if the cylinder is subjected to an internal pressure one-third the maximum pressure calculated in (i).
[Given: Allowable tensile stress in the wall = 20 ksi, Allowable shear stress in bolts and welds = 16 ksi, Modulus of elasticity of steel = 30×10^3 ksi, Poisson's ratio = 0.25].

List of Useful Formulae for CE 211

- Axial stress, $\sigma = P/A$
- Shear stress, $\tau = V/A$

- For weld design, shear stress, $\tau = V/(0.707\ Lt) \Rightarrow L = V/(0.707t\ \tau)$

- Strain, $\varepsilon = \Delta/L$
- Modulus of Elasticity, $E = \sigma_p/\varepsilon_p$
- Poisson's ratio, $\nu = -\varepsilon_{lat}/\varepsilon_{long}$
- Modulus of Resilience $= \sigma_p\ \varepsilon_p/2 = \sigma_p^2/2E$
- Shear stress, $\tau = G\ \gamma$ where G = Shear Modulus of Elasticity
- $G = E/(2\ (1 + \nu))$

❖ **Three normal and shear strains**

- $\varepsilon_{xx} = \sigma_{xx}/E - \nu\sigma_{yy}/E - \nu\sigma_{zz}/E$
- $\varepsilon_{yy} = -\nu\sigma_{xx}/E + \sigma_{yy}/E - \nu\sigma_{zz}/E$
- $\varepsilon_{zz} = -\nu\sigma_{xx}/E - \nu\sigma_{yy}/E + \sigma_{zz}/E$
- $\gamma_{xy} = \tau_{xy}/G$
- $\gamma_{yz} = \tau_{yz}/G$
- $\gamma_{zx} = \tau_{zx}/G$

❖ **Axial deformation,** $u_B - u_A = P_{xx}L/AE$

❖ **Thin-Walled Pressure Vessels**

- Transverse stress, $\sigma_t = pD/2t$
- Longitudinal stress, $\sigma_l \cong pD/4t$
- Transverse strain, $\varepsilon_t = \sigma_t/E - \nu\sigma_l/E = (pD/2Et)\ (1-\nu/2)$
- Longitudinal strain, $\varepsilon_l = \sigma_l/E - \nu\sigma_t/E = (pD/2Et)\ (0.5-\nu)$

❖ **Bolt Connections**

- $(pD/2)\ S_l = \tau_{all}\ (\pi d^2/4) \Rightarrow S_l = (\tau_{all}/p)\ (\pi d^2/2D)$
- $p\ (\pi D^2/4) = [\pi(D + t)/S_h]\ [\tau_{all}\ (\pi d^2/4)] \Rightarrow S_h \cong (\tau_{all}/p)\ (\pi d^2/D)$

❖ **Weld Connections**

- $pDL/2 = \tau_{all}\ (0.707t_l\ L) \Rightarrow t_l = (p/\tau_{all})\ (0.707D)$
- $p\ (\pi D^2/4) = \tau_{all}\ [0.707\ t_h\pi(D + t)] \Rightarrow t_h \cong (p/\tau_{all})\ (0.353D)$

❖ **Bending stress,** $\sigma_x = -M_z\ y/I_z$

- Plastic moment, $M_p = \sigma_{yp}\ Z$
- Aspect ratio, $\alpha = Z/S$
  where Z is called the plastic Section Modulus and S is called the elastic section modulus
- Shear stress, $\tau = VQ/\ \bar{I}\ b$
- Shear flow, $q = VQ/\ \bar{I}$

SET A

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title : Mechanics of Solids II
Time : 3 hour

Course Code: CE 213
Full Marks :10x10=100

(There are 14 questions. Answer **any 10.**)

1. If the section shown in Fig. a is subjected to a 10 kN-m torque, calculate the magnitude of maximum shear stress in that section. Also calculate the depth and width (B) of the section in Fig. b that has the same maximum shear stress when subjected to the same torque.

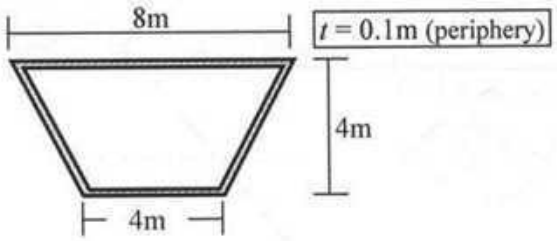


Fig. a

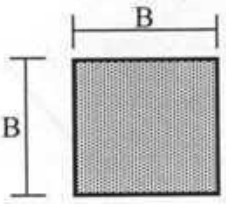
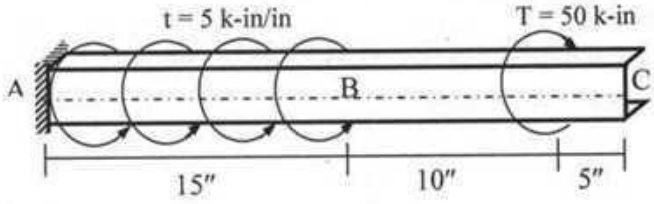
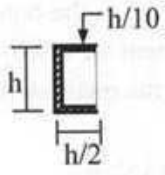


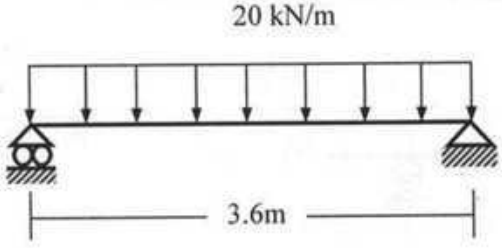
Fig. b

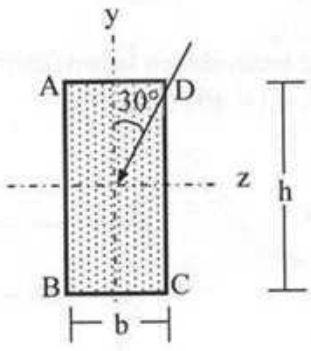
2. Calculate the required depth (h) of the channel section shown below if the allowable shear stress in beam ABC is 12 ksi and the allowable angle of twist is 1° [Given: G = 12000 ksi].



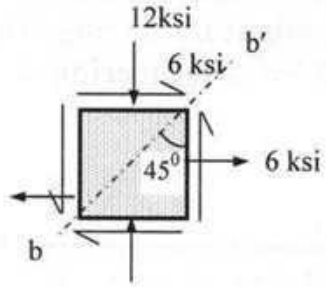


3. A simple beam with depth to width ratio of 2:1 (i.e. h=2b) has a span of 3.6 m and carries a UDL of 15 kN/m as shown below. The loading plane is inclined 30^0 clockwise with vertical. Determine the required dimension (b & h) so that the maximum stress due to bending does not exceed 12 MPa. Neglect self-weight of beam. Also locate the neutral axis.

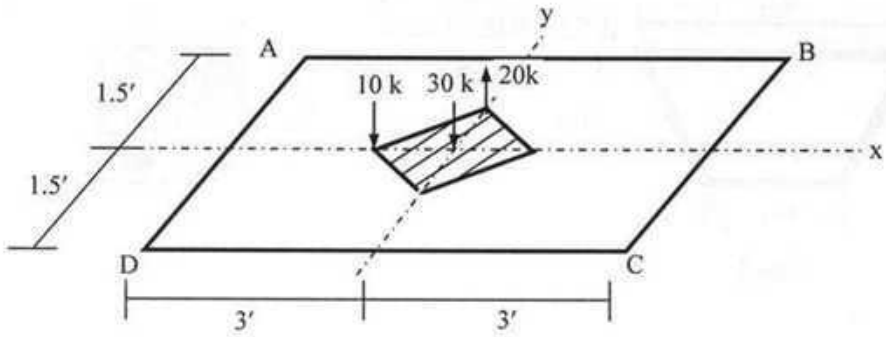




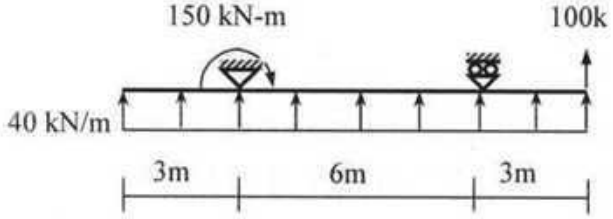
4. Using Mohr's circle of transformation of stress or stress transformation formula determine the normal and shear stresses on plane b-b' along with the principle and maximum shear stress.



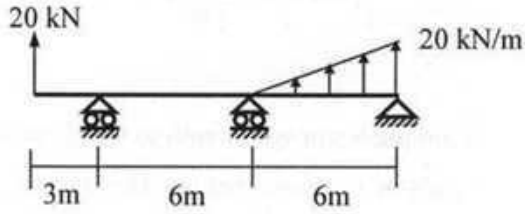
5. a) What do you mean by 'Kern' of a footing?
   b) The shaded area shown below represents the kern of the rectangular footing ABCD. For the given loads calculate the normal stresses at A, B, C and D.



6. For the beams shown below,
   a) Write the expression for loading function w(x) using singularity functions.
   b) Write down the boundary conditions.
   c) Comment on whether the beams are statically determinate or indeterminate.
   d) Draw the qualitative deflected shapes of the beams.

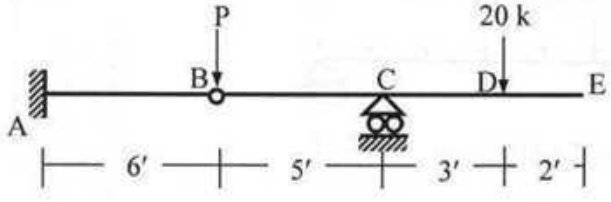


Beam1



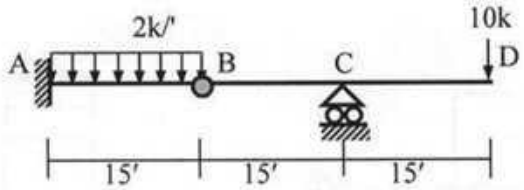
Beam2

7. For the beam shown below, calculate the force P needed to make the deflection at B equal to zero [Given: EI = 40×10^3 k-ft^2].

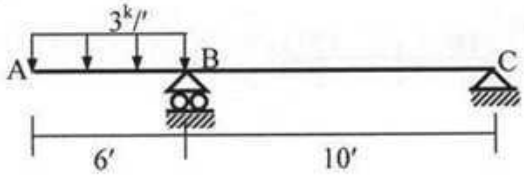


B is an Internal Hinge

8. Use singularity function method to calculate the deflection at D of the beam shown below.

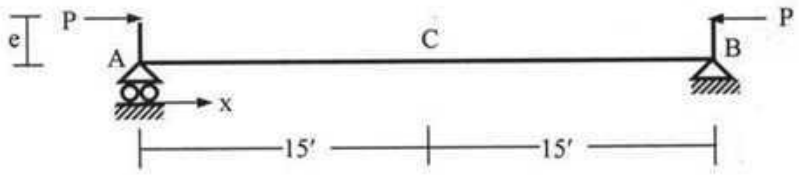


9. Calculate v_A using the moment-area theorems for the following figure [Given, $EI_{AB} = 40{,}000$ k-ft^2, $EI_{BC} = 20{,}000$ k-ft^2].

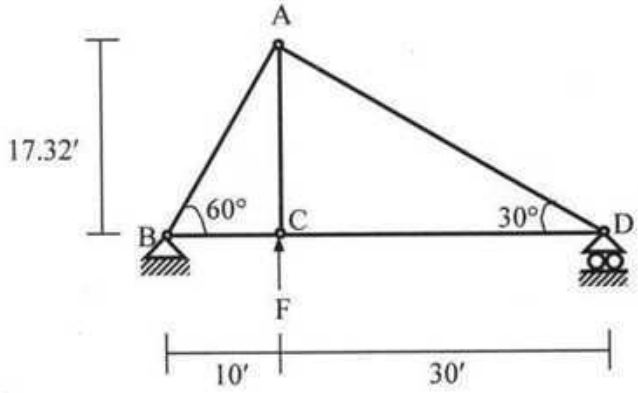


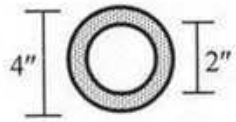
10. Answer Question 9 using the Conjugate Beam Method.

11. The beam ACB shown below is subjected to compressive loads (P) applied at both ends at an eccentricity of 'e'. If the deflection at C for P = 100 kips is 1", calculate the value of 'e' and the deflection at C for P = 200 kips [Given: $EI = 4\times10^6$ k-in^2].



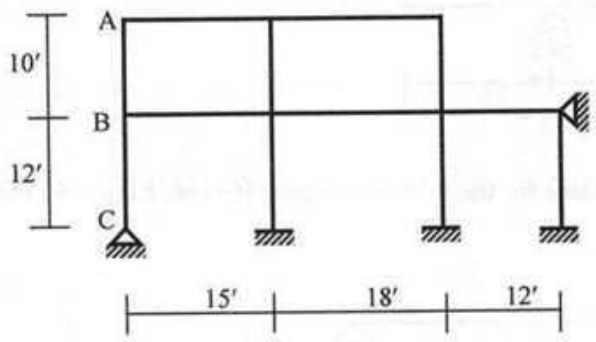
12. Use the AISC-ASD criteria to calculate the allowable value of F to avoid buckling of any member of the truss shown below [Given: Member cross-section is as shown, with E = 29000 ksi, f_y = 40 ksi].

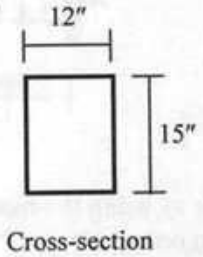




Member
X- Section

13. Calculate the Euler loads for columns AB and BC in the frame shown below [Given: E = 3000 ksi, EI = constant].





Cross-section

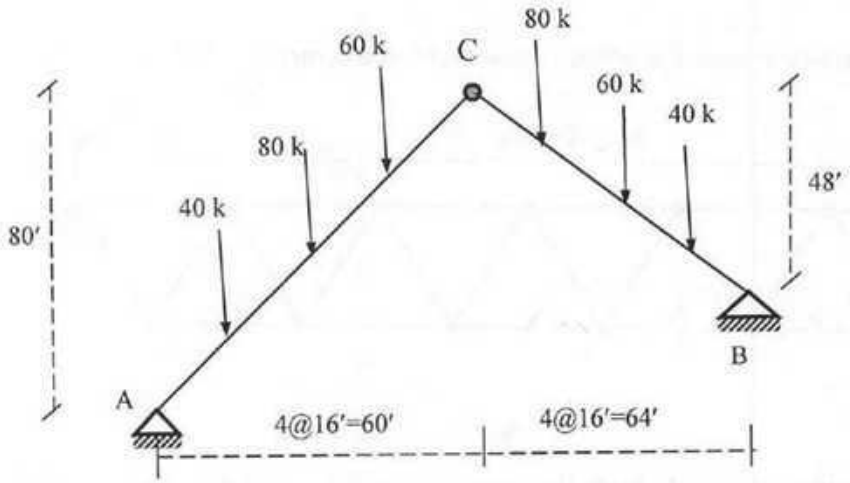
14. Prove the Euler formula of critical load for slender column and state the assumptions used for deriving the formula.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring2012
Program: B.Sc. Engineering (Civil)

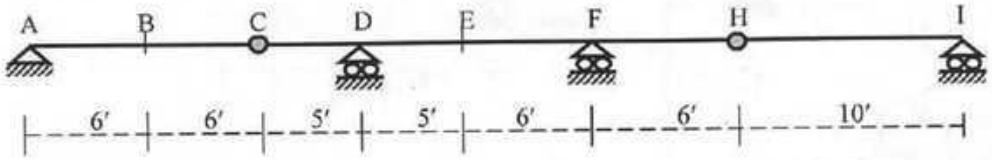
Course Title: Structural Engineering I — Time: 3.0 hours
Course Code: CE 311 (Y) Credit: 3.00 — Full Marks:**100**(=10×10)

[Answer any 10 (Ten) of the following 14 questions]

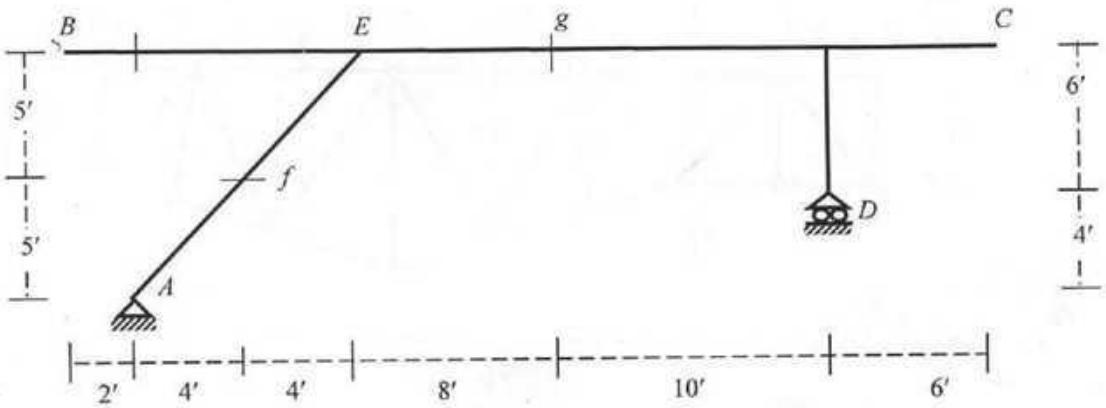
1. Draw the shear force and bending moment diagram of the frame shown below.



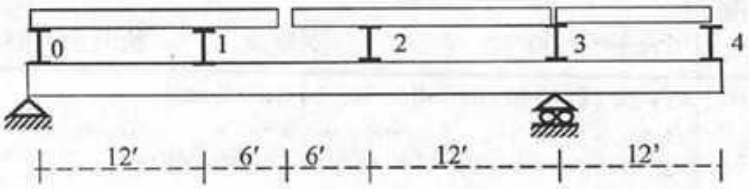
2. Draw the influence lines of V_E, V_{DL}, M_F, M_B and R_F for the beam shown below [C and H are internal hinges].



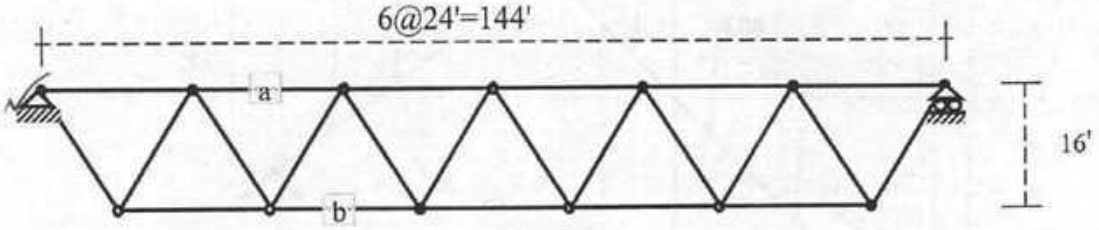
3. Draw the influence lines of V_g and M_f for the frame shown below if the unit load moves over beam *BC*.



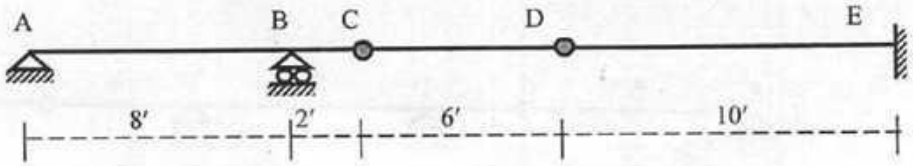
4. For the plate girder shown below, draw the influence lines of $V_{2\text{-}3}$ and M_2.



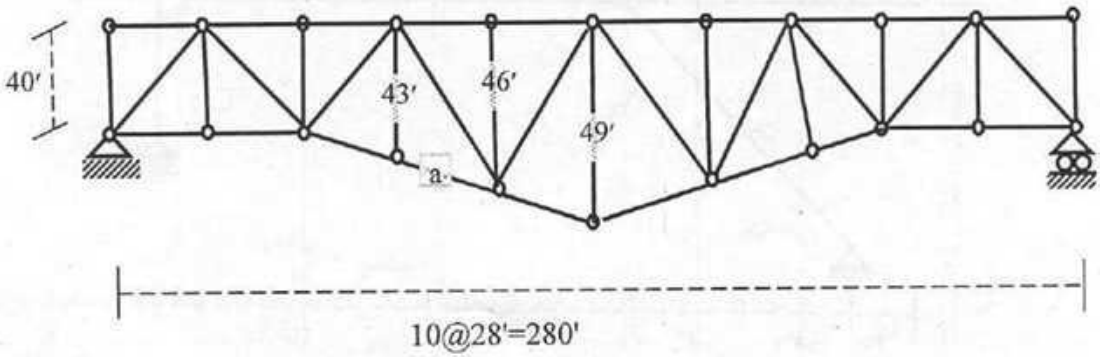
5. For the truss shown below draw the influence lines for force in member **"a"** and **"b"** [Load is moving over top cord].



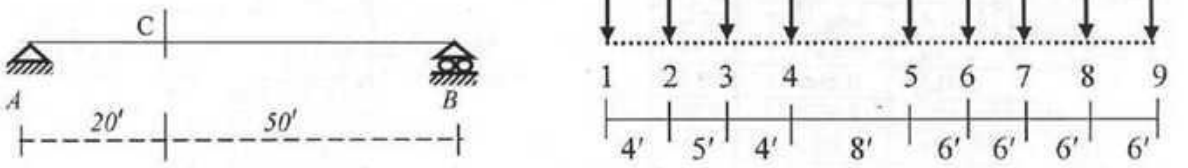
6. For the beam shown below calculate the maximum positive and negative values of reaction at support B and moment at B for a uniformly distributed dead load of 2 k/ft , moving uniformly distributed live load of 3 k/ft and a moving concentrated load of 15 k [C and D are internal hinges].



7. Calculate the maximum tensile /compressive force in member **"a"** of the truss shown below for a uniformly distributed dead load of 5 k/ft, moving uniformly distributed live load of 6 k/ft and a moving concentrated load of 60k.

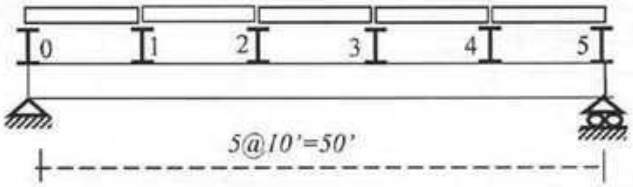


8. For the beam shown below calculate the maximum (+ ve) shear at C due to the moving wheel loads (right ⟶ left).



9. For the truss shown in Question-5 calculate the maximum tensile /compressive force in member **"b"** due to the moving loads (right ⟶ left) shown in Question-8.

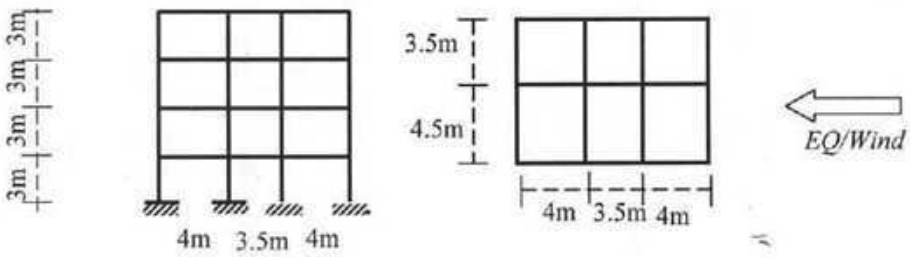
10. For the plate girder shown below calculate the maximum positive shear force of panel 1-2 due to the moving loads (right ⟶ left) shown in Question-8.



11. For the plate girder shown in Question-10 calculate the maximum M_2 due to the moving loads (left ⟶ right) shown in Question-8.

12. Develop the criterion (with net sketch) for which greatest maximum moment in a beam will occur under any load.

13. Use the Equivalent Static Force Method to calculate the seismic load at each story of the four-storied residential building (RCC) shown below located in Dhaka. Assume the structure to be a Special Moment Resisting Frame (SMRF) built on stiff soil and also assume each floor carries 150 psf D.L and 85 psf L.L. Use Annexure-1.



14. For the residential building located in Dhaka shown in Question-13 calculate the wind load at each floor. Assume Exposure-B, velocity 210 km/hr. Use Annexure-1.

Annexure-1

Height z (m)	C_z		
	Exp A	Exp B	Exp C
0~4.5	0.368	0.801	1.196
6	0.415	0.866	1.263
9	0.497	0.972	1.370
12	0.565	1.055	1.451
15	0.624	1.125	1.517
18	0.677	1.185	1.573
Height z (m)	C_G (for non-slender structures)		
	Exp A	Exp B	Exp C
0~4.5	1.654	1.321	1.154
6	1.592	1.294	1.140
9	1.511	1.258	1.121
12	1.457	1.233	1.107
15	1.418	1.215	1.097
18	1.388	1.201	1.089

h/B	C_p					
	L/B					
	0.1	0.5	0.65	1.0	2.0	≥ 3.0
≤ 0.5	1.40	1.45	1.55	1.40	1.15	1.10
1.0	1.55	1.85	2.00	1.70	1.30	1.15
2.0	1.80	2.25	2.55	2.00	1.40	1.20
≥ 4.0	1.95	2.50	2.80	2.20	1.60	1.25

Category	C_I
Essential facilities	1.25
Hazardous facilities	1.25
Special occupancy	1.00
Standard occupancy	1.00
Low-risk structure	0.80

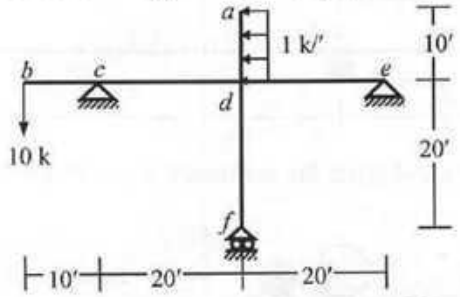
Site Soil Characteristics		Coefficient, S
Type	Description	
S_1	A soil profile with either: A rock–like material characterized by a shear–wave velocity greater than 762 m/s or by other suitable means of classification, or Stiff or dense soil condition where the soil depth exceeds 61 meters	1.0
S_2	A soil profile with dense or stiff soil conditions, where the soil depth exceeds 61 meters	1.2
S_3	A soil profile 21 meters or more in depth and containing more than 6 meters of soft to medium stiff clay but not more than 12 meters of soft clay	1.5
S_4	A soil profile containing more than 12 meters of soft clay characterized by a shear wave velocity less than 152 m/s	2.0

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012 (Set X1)
Program: B. Sc. Engineering (Civil)

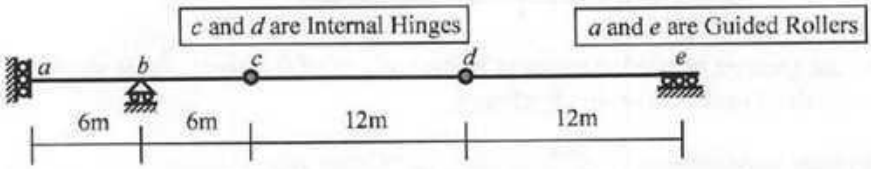
Course Title: Structural Engineering I | Credit Hours: 3.0 | Course Code: CE 311
Time: 3 hours | Full Marks: 100 (= 10 × 10)

[Answer **any 10 (ten)** of the following 14 questions]

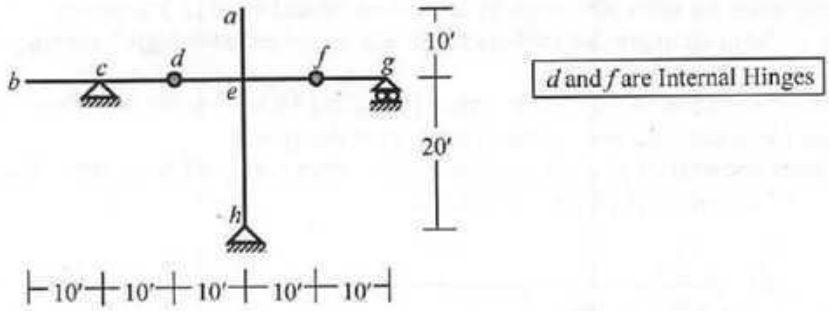
1. Determine the degree of statical indeterminacy (dosi) of the frame *abcdef* shown below. Also draw the Shear Force and Bending Moment diagrams of the frame, assuming (i) no vertical reaction at support *e*, and (ii) equal horizontal reaction at supports *c* and *e*.



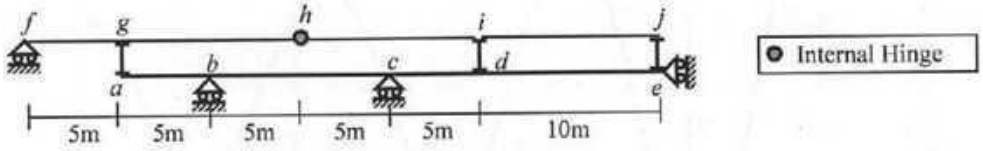
2. Determine the degree of statical indeterminacy (dosi) of the beam *abcde* shown below. Also draw the influence lines of (i) R_b, R_e, (ii) $V_{b(Right)}$, V_c, (iii) M_b and M_e.



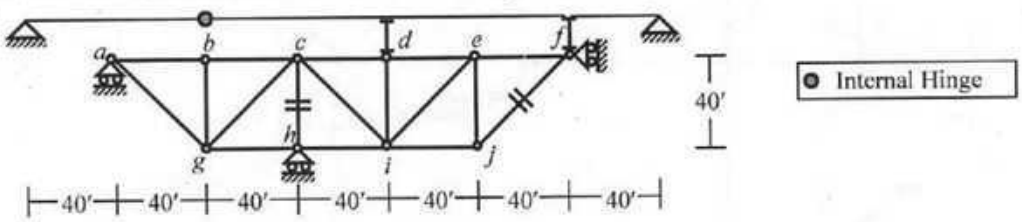
3. Determine the degree of statical indeterminacy (dosi) of the frame shown below and draw influence lines of support reactions X_c, X_h, Y_h, if unit load moves over (i) beam *bg* and (ii) column *ah*.



4. Draw the influence lines of R_b, $V_{b(Right)}$, $V_{c(Left)}$ and M_c for the plate girder *abcde* shown below, if unit load moves over the stringers at the top.



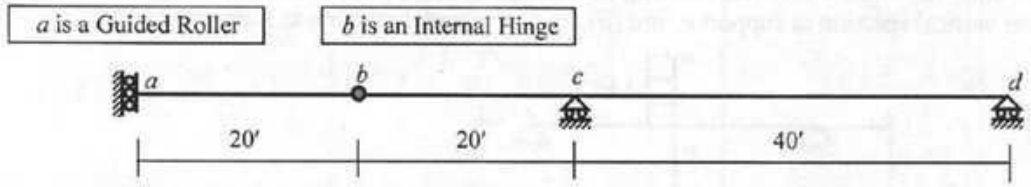
5. Draw the influence lines of the support reaction at *a* and forces in members *fj* and *ch* for the truss shown below, if unit load moves over the stringers at the top.



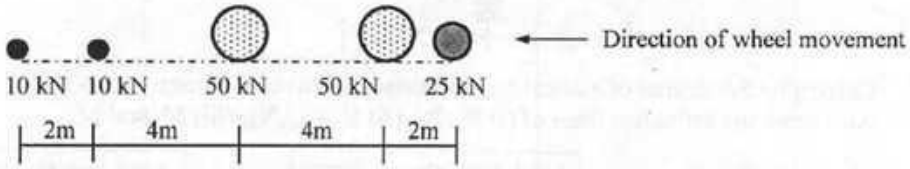
6. Calculate the maximum positive and negative values of V_d and M_a for the beam *abcde* shown in Question 2, for a uniformly distributed dead load of 10 kN/m, a moving uniformly distributed live load of 5 kN/m and a moving concentrated live load of 60 kN.

7. Calculate the maximum tensile and compressive force in member *id* and *ef* for the truss *abcdefghij* shown in Question 5, for a uniformly distributed dead load of 1 k/ft, a moving uniformly distributed live load of 0.5 k/ft and a moving concentrated live load of 10 k.

8. Draw the design shear force diagram of the beam *abcd* shown below [based on influence lines of shear forces at support *d* and the right of support *c*] for a uniformly distributed dead load of 1 k/ft and a moving uniformly distributed live load of 0.5 k/ft.



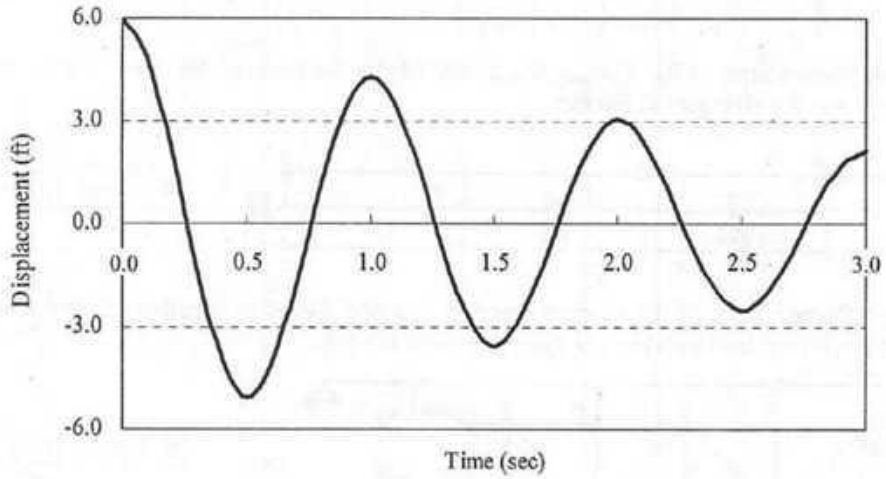
9. For the moving wheel loads shown below, calculate the maximum value of shear force at *h* in the plate girder shown in Question 4.



10. Calculate the greatest maximum moment in the span *cd* of the beam *abcde* shown in Question 2, for the moving wheel loads shown in Question 9.

11. Briefly explain why
    (i) trusses with very small angle of inclination (α) are not recommended against wind loads
    (ii) seismic loads are reduced for larger values of Response Modification Coefficient (R)
    (iii) seismic loads for taller structures include an additional force (F_t) at the top
    (iv) mass is the most important element for structures subjected at high-frequency dynamic loads.

12. Free vibration response of a dynamic system (weighing 10 kips) is shown below. Calculate the
    (i) natural frequency (ω_n) and damping ratio (ξ) of the system
    (ii) maximum dynamic displacement of the system when subjected to dynamic loads
    (a) $f(t) = 10\ Cos(2t)$, (b) $f(t) = 10\ Cos(\omega_n t)$.

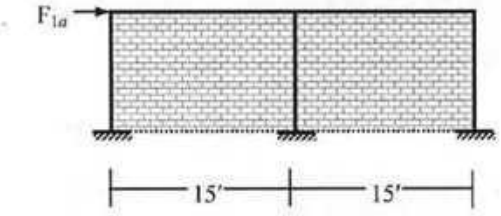


12. Figure below shows wind flowing in a particular direction and applying pressure on 1-storied residential Building *a* and 2-storied residential Building *b*.

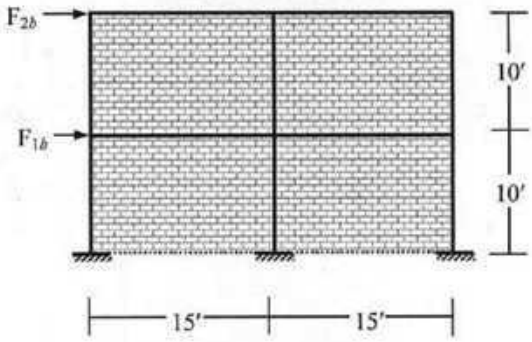
If both buildings are designed for Exposure C at the same location and flat terrain and the design wind force (F_{1a}) on Building *a* is 10 kips, calculate the

(i) basic wind velocity,

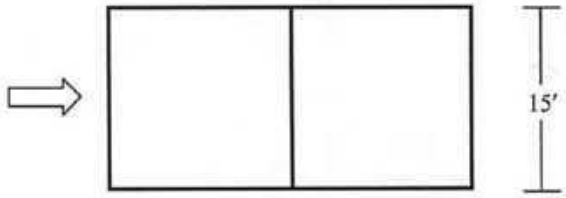
(ii) design wind forces F_{1b} and F_{2b} on Building *b*.



Side Elevation of Building *a*



Side Elevation of Building *b*



Plan View of both buildings

14. The residential RC buildings (*a* and *b*) described in Question 13 carry design dead loads of 100 lb per ft^2 and live loads of 40 lb per ft^2 of floor area.

If both buildings are designed as Ordinary Moment Resisting Frame (*OMRF*) at the same location on very soft soil and the design earthquake force (F_{1a}) on Building *a* is 5 kips, calculate the

(i) seismic zone coefficient (*Z*),

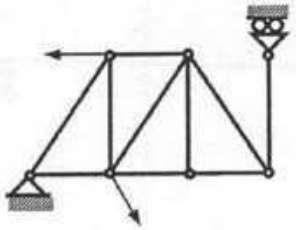
(ii) design earthquake forces F_{1b} and F_{2b} on Building *b*.

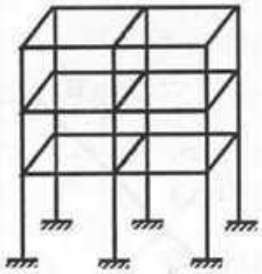
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering I — Course Code: CE 311
Time: 3 hours — Full Marks: 100(=10 x 10)

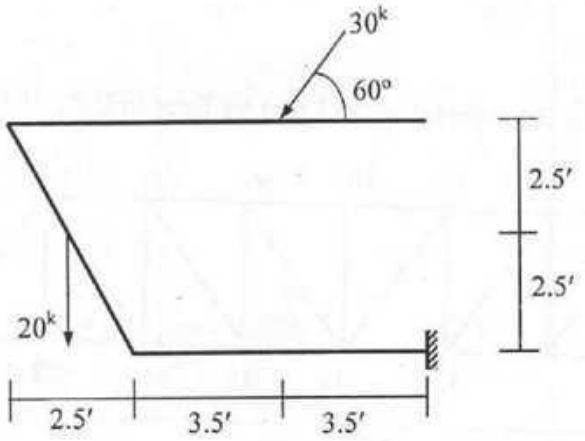
[Answer **any 10 (ten)** of the following 14 questions]

1. Determine the degree of statical indeterminacy (DOSI) of the truss and frame structure shown in the following figure.

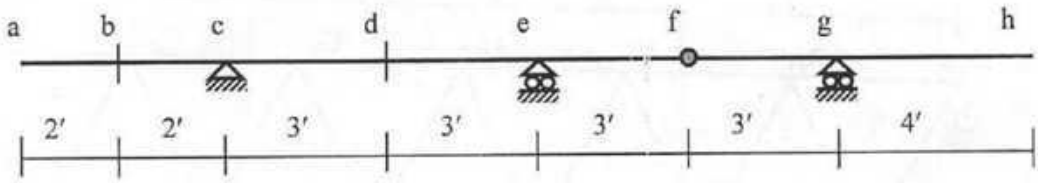




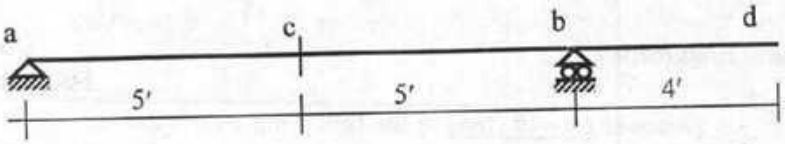
2. Draw the Axial Force Diagram (AFD), Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) of the frame structure shown below.



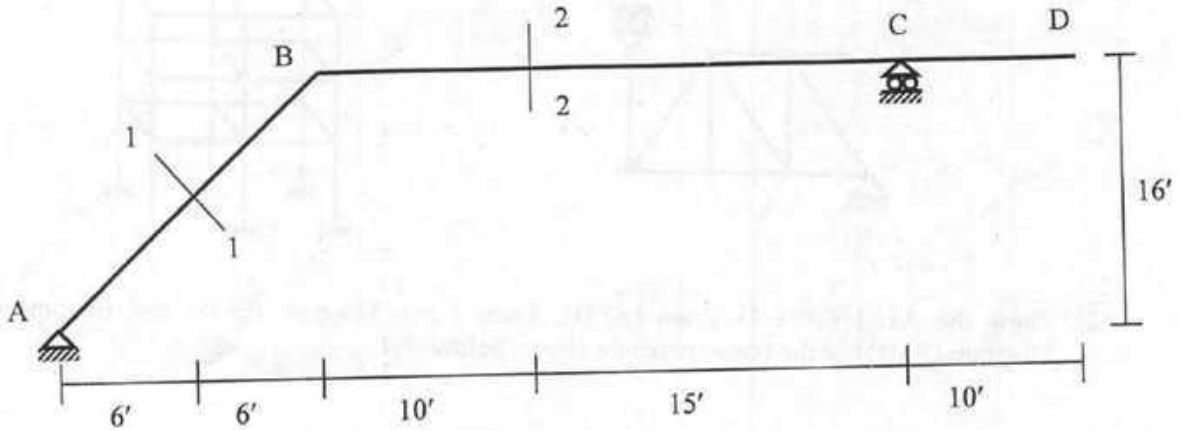
3. Draw the Influence Lines of (i)R_c , R_e(ii)V_b , V_d(iii)M_b , M_d for the beam shown in the following figure.



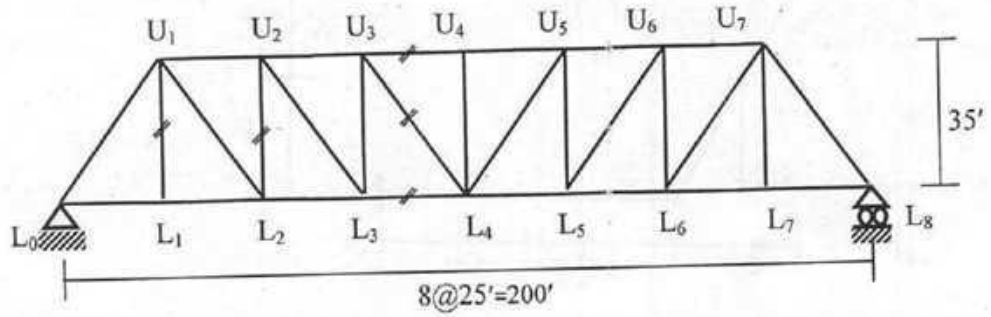
4. For the beam shown in the following figure, calculate the maximum live load shear and moment at section c for a moving uniformly distributed live load of 0.5 kip/ft and a moving concentrated load of 15 kip.



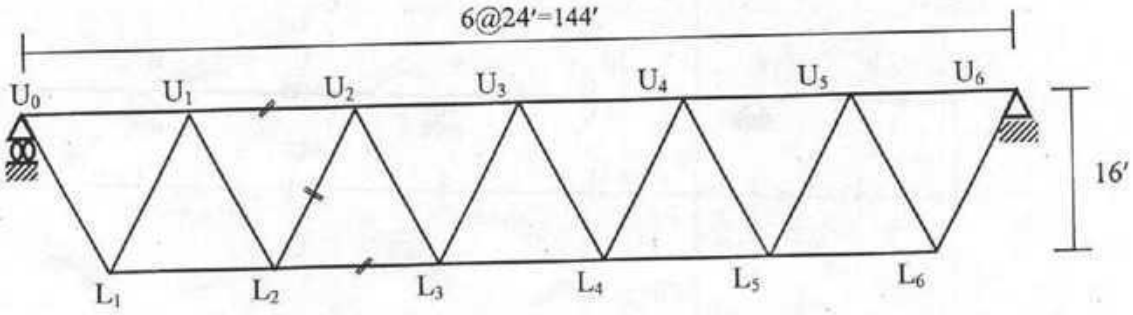
5. Draw the Influence Lines of (i)V_1 , V_2 (ii) M_1 , M_2 for the frame shown in the following figure considering live load movement from point B to point D.



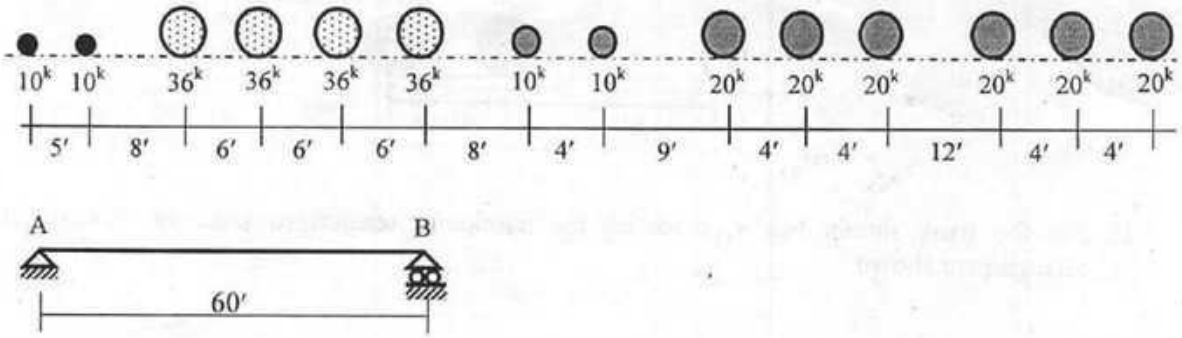
6. For the truss shown below, draw the Influence Lines for force in U_1L_1, U_3U_4, L_3L_4, U_3L_4, U_2L_2.



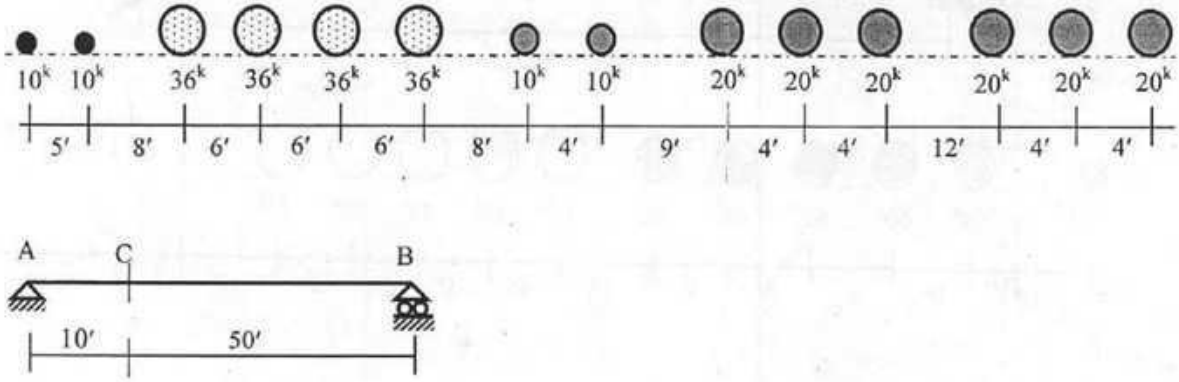
7. For the truss shown below, draw the Influence Lines for force in L_2L_3, L_2U_2, U_1U_2.



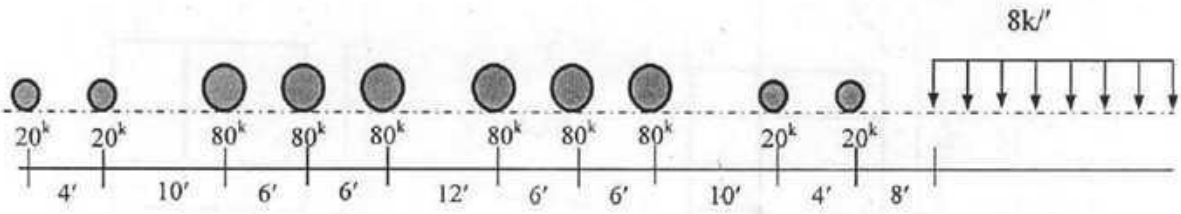
8. Calculate the maximum value of R_A for the beam AB for the wheel load arrangement shown in the following figure.



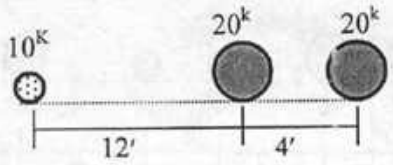
9. Calculate the maximum value of V_C for the beam AB for the wheel load arrangement shown in the following figure.



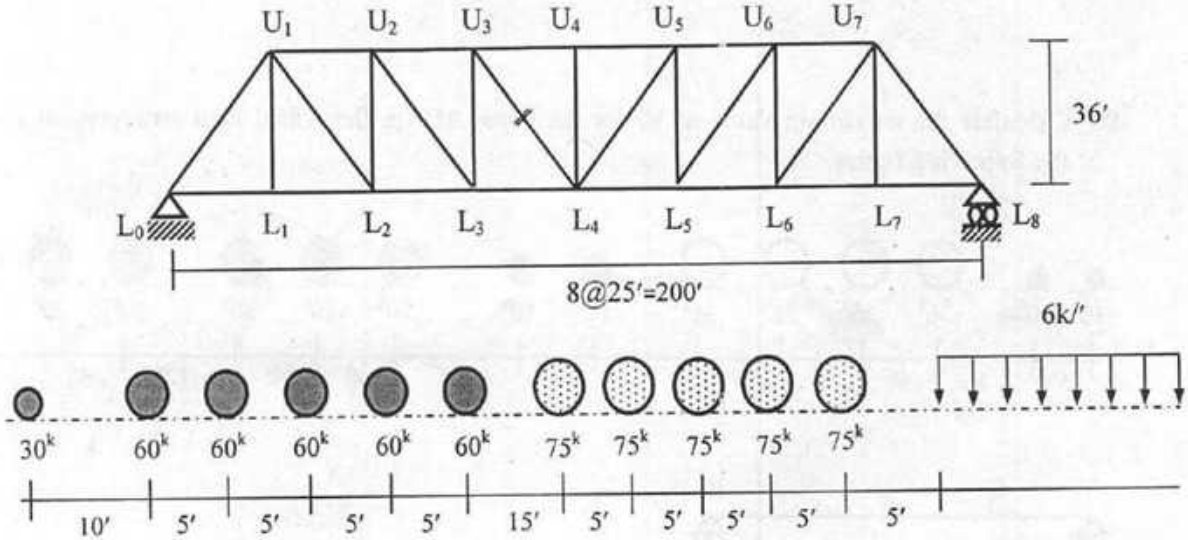
10. Due to the wheel load shown below, calculate the maximum moment at the quarter point of a simply supported span of 80′.



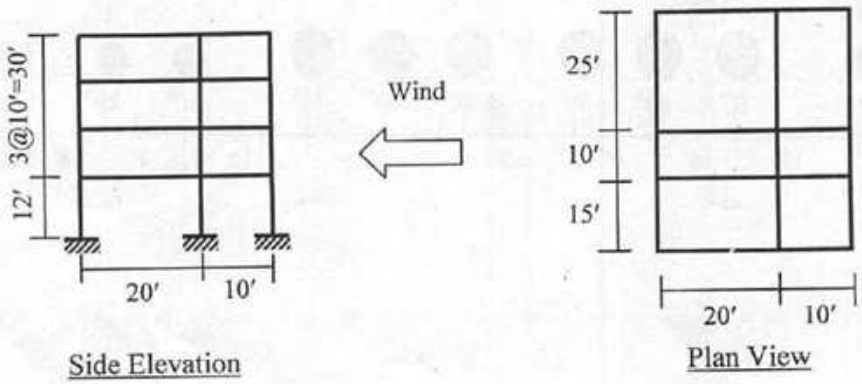
11. Calculate the absolute maximum moment on a span of 24′ for the wheel load arrangement shown in the following figure.



12. For the truss shown below, calculate the maximum tension in U_3L_4 for the wheel load arrangement shown.



13. Calculate the wind load at each storey of a four-storied low-risk-structure type building (shown in the following figure) located at a flat terrain in Rajshahi. Assume the structure to be subjected to Exposure C. (Necessary charts are attached with the question paper).



Side Elevation

Plan View

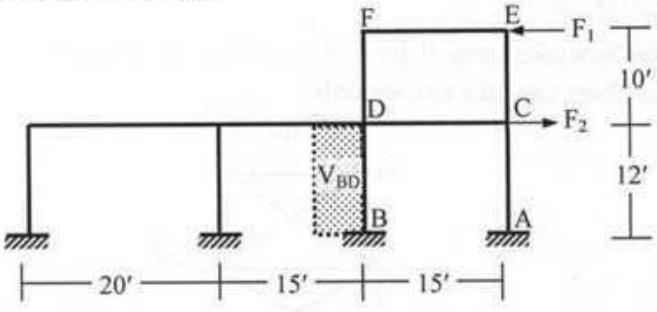
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title : Structural Engineering II
Time : 3 hours

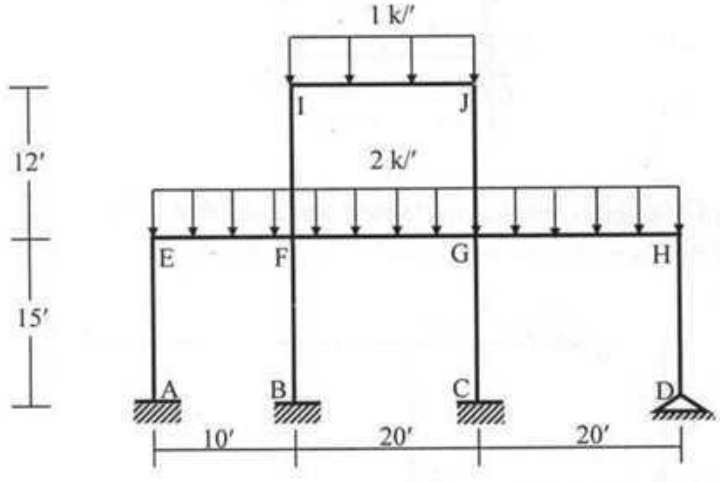
Course Code: CE 313
Full Marks :10x10=100

(There are **14** questions. Answer any **10)**

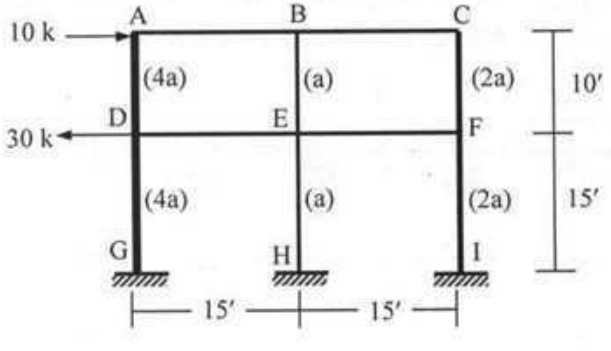
1. The figure below shows the applied loads (F_1, F_2) and shear force (V_{BD}) in column BD of a two-storied frame. If $F_2 = 40$ k, and $V_{BD} = 10$ k, use the Portal Method to calculate the
   (i) applied load F_1
   (ii) bending moments of column BDF.



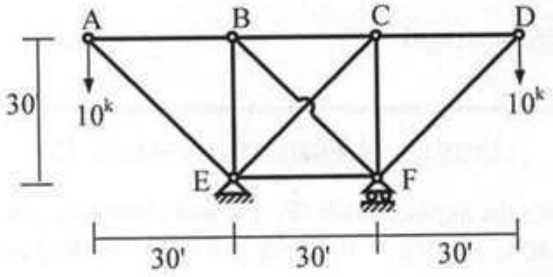
2. Analyze the two-storied frame structure loaded as shown below using the approximate location of hinges to draw the bending moment diagrams of the beams and columns.



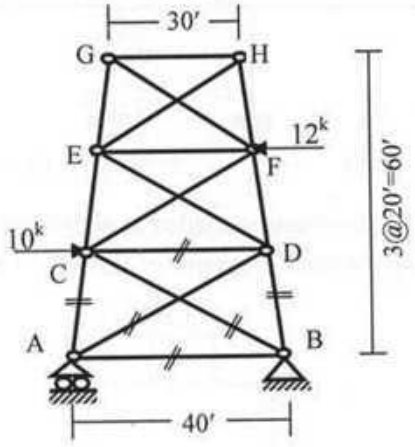
3. For the structure shown below, use the Cantilever Method to draw BMD of all the columns and beams. The cross-sectional areas of the columns are given in the parenthesis.



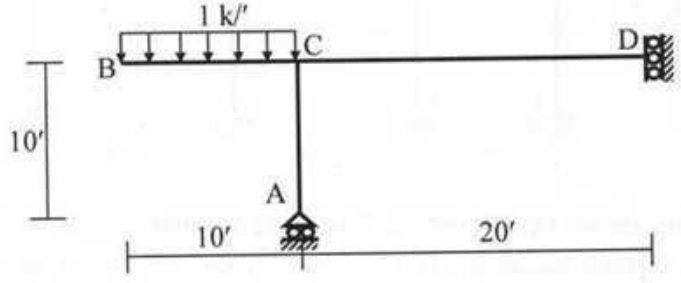
4. Use the Method of Virtual Work to calculate the vertical deflection at point A of the truss loaded as shown, assuming diagonal members to take equal share of the sectional shear [Given: EA/L = constant = 500 k/ft] .



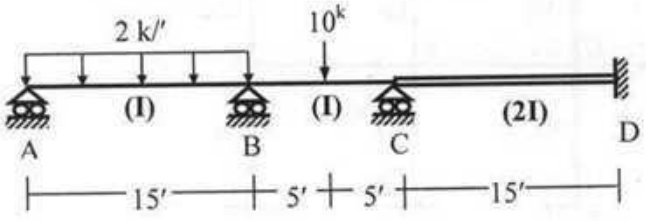
5. Calculate the member forces AB, AC, AD, BC and BD of the statically indeterminate truss shown below assuming
   (i) Diagonal members take equal share of the sectional shear force
   (ii) Diagonal members can take tension only.



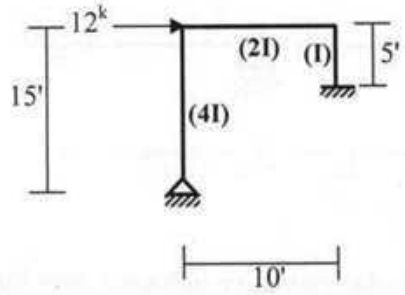
6. Use the Unit Load Method (considering flexural and axial deformations) to calculate the vertical deflection at D of the frame loaded as shown below [Given: $EI = 40\times10^3$ k-ft^2, $EA = 400\times10^3$ k].



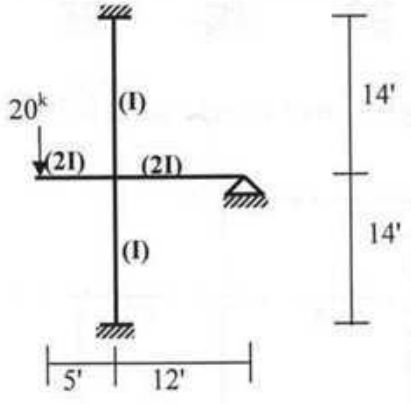
7. Use the Moment Distribution Method to calculate the joint moments and draw the bending moment diagram of beam ABCD. Member inertia (I) is given in the parenthesis.



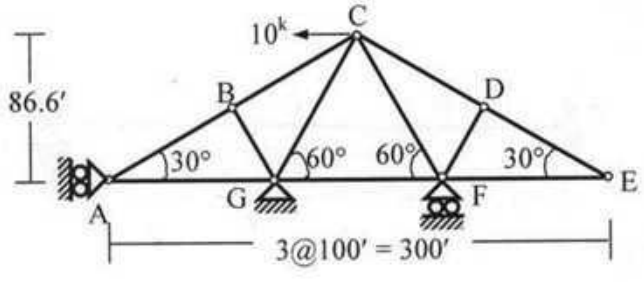
8. Use moment distribution method to draw SFD and BMD for the following frame. Member inertia (I) is given in the parenthesis.



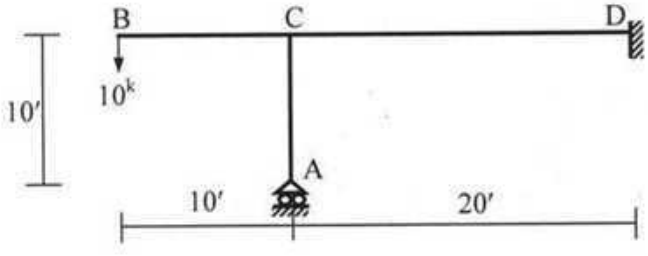
9. Use moment distribution method to draw SFD, BMD and deformed shape of the following frame. Member inertia (I) is given in the parenthesis.



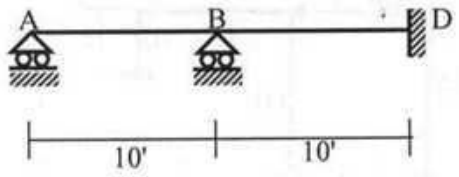
10. Use the Flexibility Method to calculate the member force of the truss loaded as shown below [Given: EA/L = constant = 1000 kip/ft].



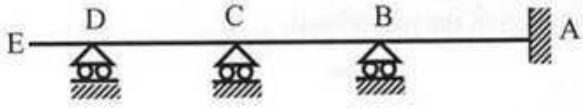
11. Use the Flexibility Method (considering flexural deformations only) to draw the bending moment diagram of the frame shown below, if in addition to the applied load, support D settles 0.10' downward [Given: $EI = 40\times10^3$ k-ft^2].



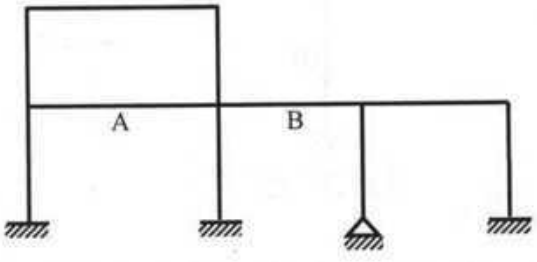
12. Use the Flexibility Method (considering flexural deformations only) to draw the bending moment diagram of the beam shown below if support B settles 0.1' [Given: EI = 40×10^3 k-ft^2].



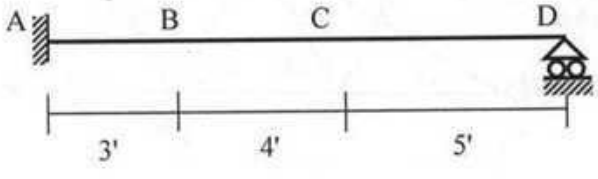
13. i) For the beam shown below, draw the qualitative influence lines for V_A, $V_{B(R)}$, $V_{D(L)}$ and M_D.



ii) For the frame shown below, draw the qualitative influence lines for V_A and M_B.



14. Draw the influence line for the vertical reaction at A and determine the quantitative value at B and C [Given: EI = constant].



SET-X

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc Engineering (Civil)

Course Title: Design of Concrete Structures I — Course Code: CE 315
Time: 3.00 Hours — Full Marks: 120

Section A

(Answer **any 3 (three)** of the following 4 questions)

Full Marks: 36 [=3×(6+6)]

1. (i) Derive the expression for the ultimate moment capacity of a beam which is over reinforced.

   (ii) What do you mean by balanced steel ratio in USD? Derive the expression for balanced steel ratio of a beam for USD.

2. (i) Explain the terms Web-Shear Crack and Flexure-Shear Crack. Also explain why the Web-Shear Stress is greater than Flexure-Shear Stress.

   (ii) Draw a neat sketch showing diagonal crack in a beam with vertical stirrups. Show the forces acting at the crack and discuss them. Using the sketches and following ACI code recommendations derive the following equation for the spacing of stirrups:

   $$S = A_v f_v d/(V_{est} - V_{cr})$$

   The symbols carry their usual meaning.

3. (i) Explain the differences between flexural stress distribution over T- and rectangular beams (and their effects).

   (ii) Write down the ACI code requirements for clear cover of beam and slab, and minimum clear spacing of bars of beam and maximum spacing of bars in slab.

4. (i) What is one-way slab? Explain with reference to support conditions and slab span ratios. Explain temperature and shrinkage reinforcements and discuss their necessity in reinforced concrete design with reference to slabs.

   (ii) What is development length? Mention the factors influencing development length of deformed tension bars. Briefly compare between the development lengths of
   (a) bottom and top bars, (b) epoxy-coated and uncoated bars.

Section B

(Answer **any 7 (seven)** of the following **10** questions)

Full Marks: 84 [=7×12]

[Given: $f_c' = 4$ ksi, $f_y = 60$ ksi, $f_s = 24$ ksi for all questions]

5. **(a)** Identify the beam sections shown in Figure 1(a) as under-reinforced, balanced and over-reinforced by USD.

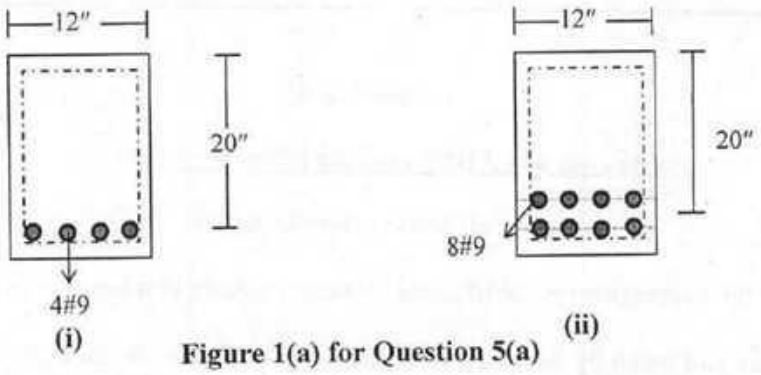


Figure 1(a) for Question 5(a)

(b) Calculate the ultimate and allowable moment capacity of the beam section shown in Figure 1(b).

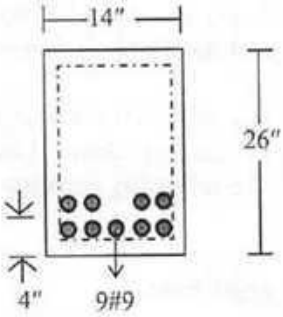


Figure 1(b) for Question 5(b)

6. Design and detail a singly reinforced beam section at mid-span with a simple span of 30′ to support a dead load of 1.00 k/ft (excluding self weight) and a live load of 2.0 k/ft(see Figure 2). Width of the beam = 12 inch (architectural requirement). **Use ACI/USD method.**

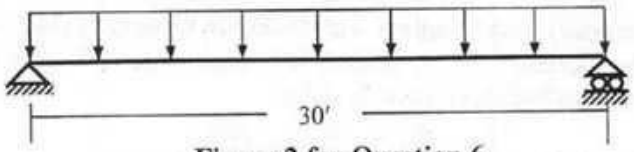


Figure 2 for Question 6

7. A rectangular concrete beam 12″ wide has an effective depth of 18″. Compression steel consisting of 2#8 bars is located 2.5 inch from the compression face of the beam. Find the ultimate moment capacity of the beam, according to ACI Code for the following alternative area of tensile steel:

(i) A_s= 3# 10 bars in one layer
(ii) A_s= 4#10 bars in two layers
(iii) A_s= 6#10 bars in two layers.

Figure 5 for Question 10

8. A beam of size 10"×20" is chosen due to architectural reasons to support a dead load of 1 k/ft (excluding self weight) and live load of 2 k/ft on a cantilever span of 10 '(Figure 3). Is it singly reinforced or doubly reinforced? Design and detail the beam section at support.
Use **ACI/USD** method.

w_D = 1 k/ft (excluding self weight) w_L = 2 k/ft

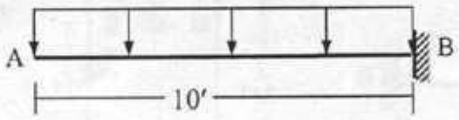
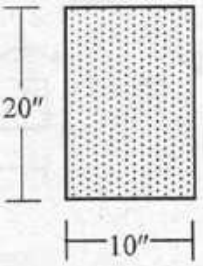


Figure: 3 for Question 8



beam cross-section at support

9. Determine design moment for the "T" beam as shown in Figure 4 and then determine the allowable live load on the slab. FF= 20 psf, Random Wall Loads= 30 psf. Use either **WSD or USD.**

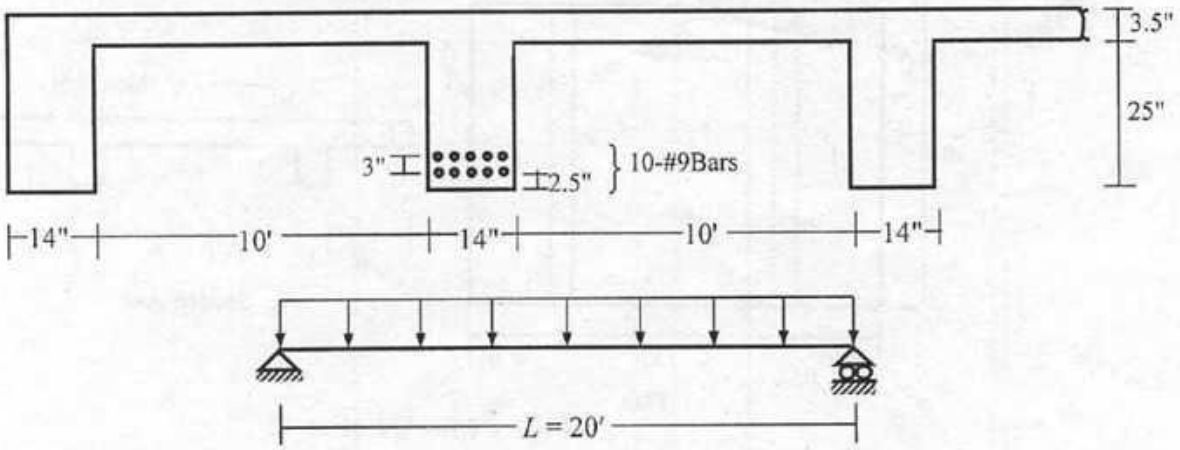
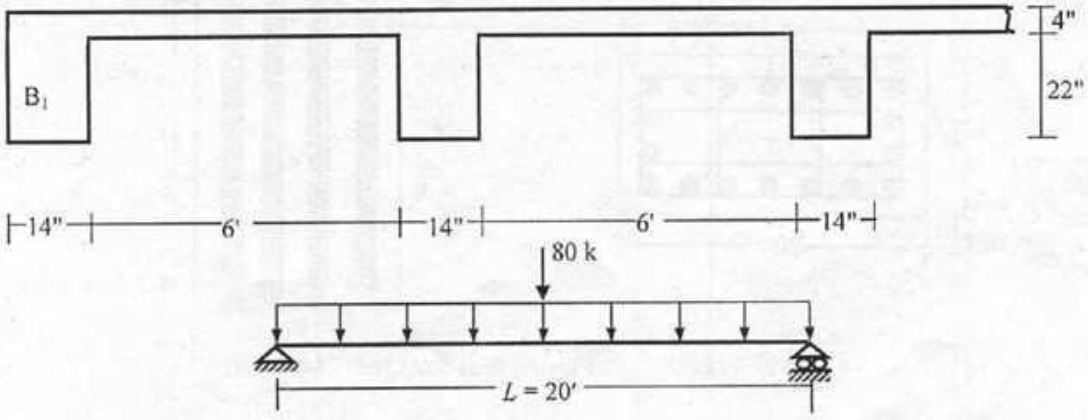


Figure 4 for Question 9

10. A floor slab 4 inch thick is supported by reinforced concrete beams, 7 ft c/c, which together with slab act as T-beams (see Figure 5). The slab supports a service live load of 200 psf and a superimposed dead load of 100 psf. Moreover each of the beams supports a concentrated live load of 80 k at midspan in addition to the load from slab. Design and detail the L-beam 'B1' as shown in Figure 5. Use **ACI/USD** method.



11. If the beam as shown in Figure 6 carries a total factored load of 5.0 k/ft, determine the region for which web reinforcement is required. If #3 rebar is selected as web reinforcement what will be the spacing of U stirrup for maximum shear to be considered for design? Also compare your calculated spacing with the value suggested by the ACI code.

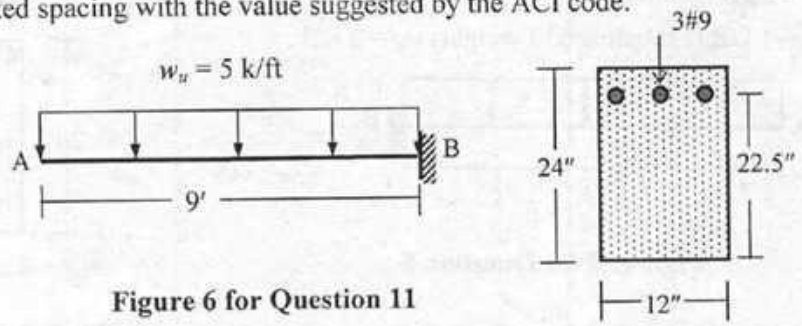


Figure 6 for Question 11

12. A 6 in. thick slab (one way) is supported on RC beams as shown in Figure 7. The calculated total dead load on the slab is 100 psf 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 design moments and show the necessary reinforcements in sketches. Use either **WSD or USD.**

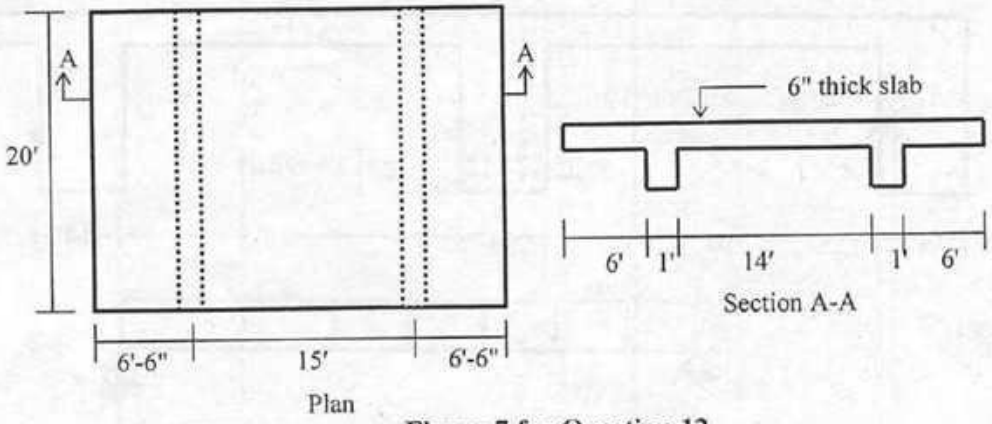


Figure 7 for Question 12

13. **(a)** If # 6 bars are to be spliced to #7 bars, for the tied column (see Figure 8a), what will be the minimum required lap length (l_{splice}) for the splice.

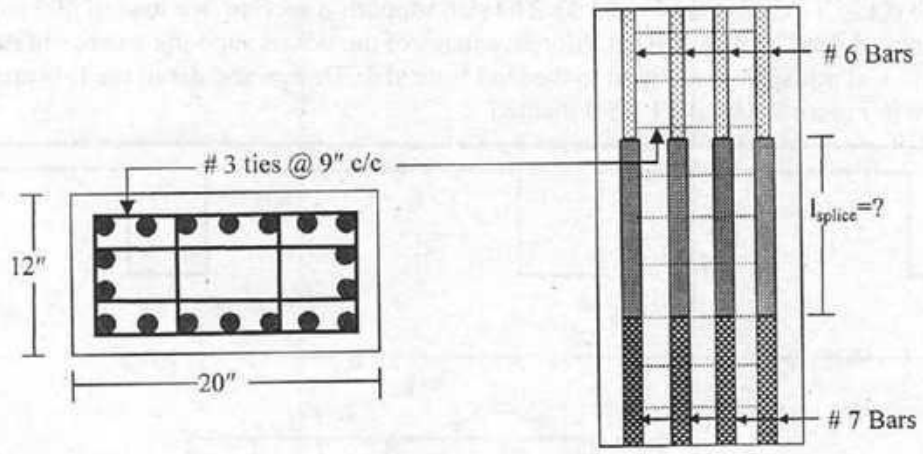
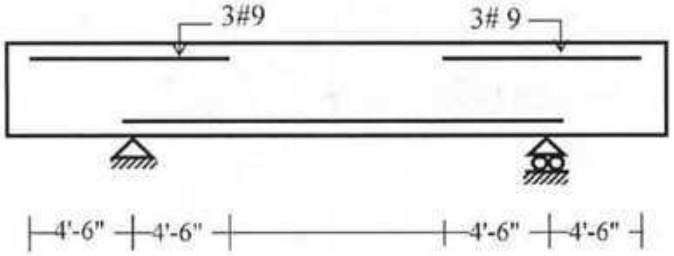


Figure 8(a) for Question 13(a)

b. The required top or negative steel area for the normal weight concrete beam of Figure 8(b) is 2.76 in.^{2}. Three #9 bars (uncoated) have been selected. Are the 4'-6" development lengths shown satisfactory?



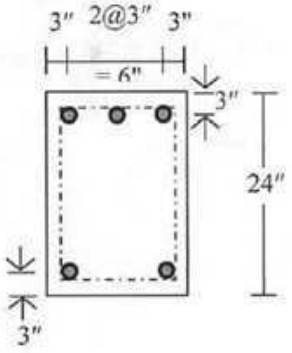
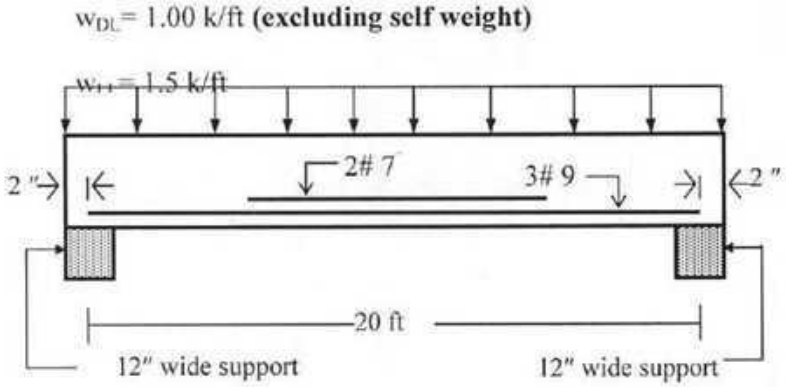


Figure 8(b) for Question 13(b) Beam section at support

14. **(a)** The beam (simple span=20 ft) shown in the Figure 9 is to carry a dead load of 1 kip/ft (excluding self weight) and a live load of 1.5 kip/ft. The reinforcement consist of 3#9 bars and 2#7 bars. Given: $A_{s\,(supplied)} = A_{s\,(required)}$.

(i) Calculate the point where the upper 2 #7 bars can be discontinued.
(ii) Check whether adequate embedment length is provided for continued and discontinued rebars. Follow ACI/USD method.

(b) In reference to Question 14(a), check the shear at cut-off point in accordance with ACI code and redesign the stirrup spacing if necessary
[Given: Stirrup provided at cut-off point is #3, 2Legged @7 inch c/c].



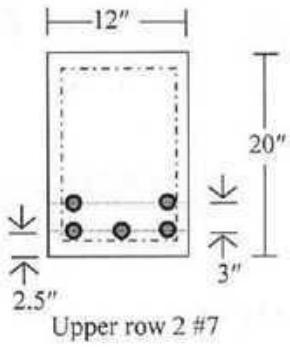


Figure 9 for Question 14

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012 (Set Y)
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures I | Credit Hours: 3.0 | Course Code: CE 315
Time: 3 hours | Full Marks: 100 (= 10 × 10)

PART A

[Answer **any 7 (seven)** of the following 10 questions]

Full Marks: 70 [= 7 × 10]

[Given: $f_c' = 3$ ksi, $f_y = 50$ ksi for all questions]

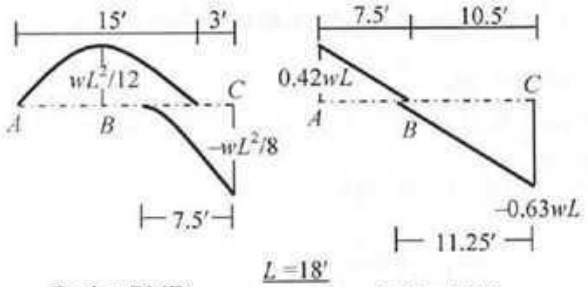


Fig. 1

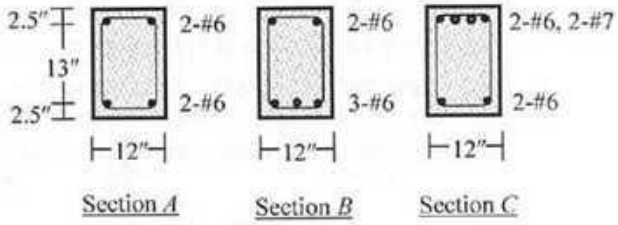


Fig. 2

1. Use the design BMD of beam *ABC* (Fig. 1) to calculate the maximum allowable load (w) for the Section *C* to remain 'uncracked', considering it is reinforced
   (i) as shown in Section *C* of Fig. 2, (ii) by only the tension bars in Section *C* of Fig. 2.

2. Use the design BMD of beam *ABC* (Fig. 1) to
   (i) calculate the total load (w_u) for Section *B* (Fig. 2) to reach its ultimate moment capacity, and
   (ii) compare it with the w_u ignoring compression bars (i.e., assuming Section *B* is singly reinforced).

3. Use WSD to design (with neat sketches) rectangular sections ($b = 12''$, $h = 18''$) at *B* and *C* for the design BMD of *ABC* (Fig. 1), considering allowable load w to keep section B singly reinforced.

4. Use USD to design (with neat sketches) rectangular sections ($b = 12''$, $h = 18''$) at *B* and *C* for the design BMD of *ABC* (Fig. 1), considering ultimate load w_u to keep section B singly reinforced.

5. Use WSD to design (with neat sketch of longitudinal profile) inclined stirrups ($\alpha = 45°$) for rectangular sections ($b = 12''$, $h = 18''$) at *A* and *C* using the design SFD of *ABC* (Fig. 1), if w is the maximum load the beam can carry in shear [Assume 12″ square columns at *A* and *C*].

6. Use USD to design vertical stirrups for section *C* of beam *ABC* (with $b = 12''$, $h = 18''$) using the design SFD (Fig. 1), if w_u is the ultimate load the beam can carry in shear, and it is also subjected to (i) compressive force of 50 k, (ii) tensile force of 50 k [Assume 12″ square columns at *A* and *C*].

7. Fig. 2 shows cross-sections *A*, *B* and *C* of beam *ABC* (made of normal-weight concrete and uncoated bars) supported by 12″ square columns at *A* and *C*.

   The beam is reinforced with #3 stirrups spaced @5″c/c near *A*, *C* and @8″c/c near *B*.

   (i) Calculate the development lengths and lap lengths (with suitable location) of the longitudinal bars (a) with end anchorage, (b) without end anchorage.

   (ii) Use Fig. 1 to draw the longitudinal profile of the beam reinforcements, specifying points where the top and bottom bars can be cut off.

8. Use the design BMD of beam *ABC* (Fig. 1) to design the L-beam (by USD) and T-beam (by WSD) at section *B* (i.e., with design moment = $wL^2/12$, where $L = 18'$) of the slab-beam system (Fig. 3), if slab thickness $t = 4''$, floor finish = 30 psf, random wall = 60 psf and live load = 60 psf.

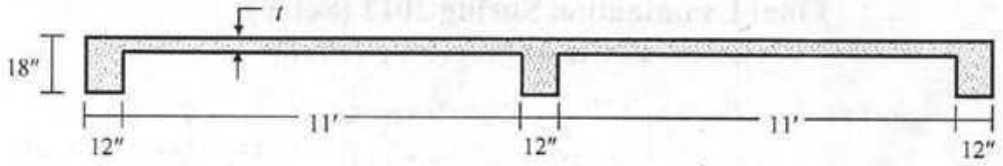


Fig. 3

9. Fig. 3 shows sectional view of a one-way slab-beam system (i.e., unsupported in the other direction). Determine the thickness (t) of the slab and use the WSD to calculate the
   (i) Live load (LL) on the slab if the T-beam carries working load of 3 k/ft, assuming the slab to carry working loads including floor finish = 30 psf, random wall = 60 psf, in addition to self-weight and LL.
   (ii) Use ACI moment coefficients (−1/24, 1/14, −1/9) to design the slab (with neat sketch of section).

10. Fig. 4 shows a staircase simply-supported on 10" brickwalls.
    Determine the thickness (t) of the waist-slab and use USD (with $\rho_s = 0.25\rho_{max}$) to calculate the
    (i) allowable live load on the staircase if FF = 25 psf,
    (ii) required reinforcements in the slab (and show them with neat sketch).

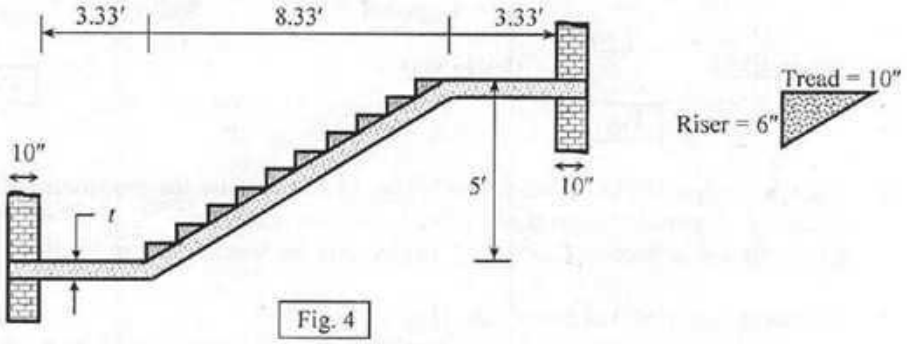


Fig. 4

PART B

[Answer **any 3 (three)** of the following 4 questions]

Full Marks: 30 [= 3 × (5 + 5)]

11. (i) What are the maximum and minimum allowable steel ratios used for RC beams? Explain why they are used.
    (ii) Show the variations of stress and strain over a RC section as it is stressed gradually from uncracked to cracked and ultimate failure condition.

12. (i) Explain the terms Web-Shear Crack and Flexure-Shear Crack. Also explain why the Web-Shear Stress is greater than Flexure-Shear Stress.
    (ii) Narrate the advantages and disadvantages of inclined stirrups compared to vertical stirrups.

13. (i) Mention the distinctive features of the shear design of deep beams.
    (ii) Narrate the ACI code provisions for choosing the minimum thickness of one-way slabs. Explain why the required thickness of slabs increases with the yield strength of reinforcing steel.

14. (i) Briefly explain the effects of
    (a) Reinforcement Location Factor, (b) Cover Dimension (c) Transverse Reinforcement Index on the development length of reinforcing bars.
    (ii) What are bar splices? Distinguish between lap splices in tension and compression.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012 (Set Z)
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures I | Credit Hours: 3.0 | Course Code: CE 315
Time: 3 hours | Full Marks: 100 (= 10 × 10)

PART A

[Answer **any 7 (seven)** of the following 10 questions]

Full Marks: 70 [= 7 × 10]

[Given: $f_c' = 4$ ksi, $f_y = 60$ ksi for all questions]

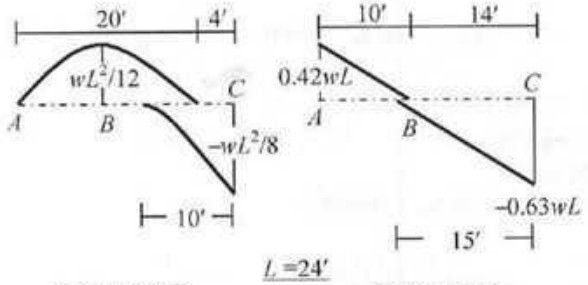


Fig. 1

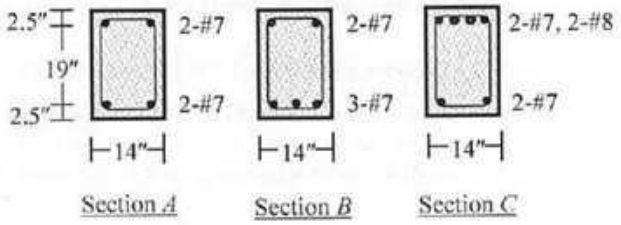


Fig. 2

1. Use the design BMD of beam *ABC* (Fig. 1) to calculate the maximum allowable load (w) for the Section *C* to remain 'uncracked', considering it is reinforced
   (i) as shown in Section *C* of Fig. 2, (ii) by only the tension bars in Section *C* of Fig. 2.

2. Use the design BMD of beam *ABC* (Fig. 1) to
   (i) calculate the total load (w_u) for Section *B* (Fig. 2) to reach its ultimate moment capacity, and
   (ii) compare it with the w_u ignoring compression bars (i.e., assuming Section *B* is singly reinforced).

3. Use WSD to design (with neat sketches) rectangular sections (b = 14", h = 24") at *B* and *C* for the design BMD of *ABC* (Fig. 1), considering allowable load w to keep section B singly reinforced.

4. Use USD to design (with neat sketches) rectangular sections (b = 14", h = 24") at *B* and *C* for the design BMD of *ABC* (Fig. 1), considering ultimate load w_u to keep section B singly reinforced.

5. Use WSD to design (with neat sketch of longitudinal profile) inclined stirrups (α = 45°) for rectangular sections (b = 14", h = 24") at *A* and *C* using the design SFD of *ABC* (Fig. 1), if w is the maximum load the beam can carry in shear [Assume 14" square columns at *A* and *C*].

6. Use USD to design vertical stirrups for section *C* of beam *ABC* (with b = 14", h = 24") using the design SFD (Fig. 1), if w_u is the ultimate load the beam can carry in shear, and it is also subjected to (i) compressive force of 75 k, (ii) tensile force of 75 k [Assume 14" square columns at *A* and *C*].

7. Fig. 2 shows cross-sections *A*, *B* and *C* of beam *ABC* (made of normal-weight concrete and uncoated bars) supported by 14" square columns at *A* and *C*.

   The beam is reinforced with #3 stirrups spaced @6"c/c near *A*, *C* and @10"c/c near *B*.

   (i) Calculate the development lengths and lap lengths (with suitable location) of the longitudinal bars (a) with end anchorage, (b) without end anchorage.

   (ii) Use Fig. 1 to draw the longitudinal profile of the beam reinforcements, specifying points where the top and bottom bars can be cut off.

8. Use the design BMD of beam *ABC* (Fig. 1) to design the L-beam (by USD) and T-beam (by WSD) at section *B* (i.e., with design moment = $wL^2/12$, where $L = 24'$) of the slab-beam system (Fig. 3), if slab thickness $t = 5''$, floor finish = 30 psf, random wall = 60 psf and live load = 60 psf.

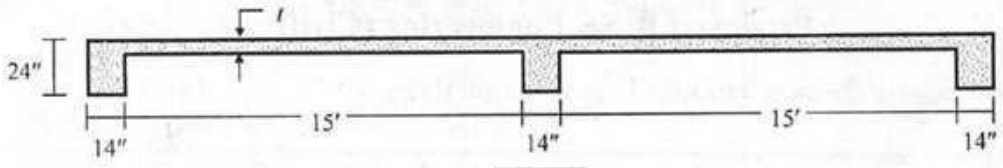


Fig. 3

9. Fig. 3 shows sectional view of a one-way slab-beam system (i.e., unsupported in the other direction). Determine the thickness (t) of the slab and use the WSD to calculate the
   (i) Live load (LL) on the slab if the T-beam carries working load of 4 k/ft, assuming the slab to carry working loads including floor finish = 30 psf, random wall = 60 psf, in addition to self-weight and LL.
   (ii) Use ACI moment coefficients (−1/24, 1/14, −1/9) to design the slab (with neat sketch of section).

10. Fig. 4 shows a staircase simply-supported on 10″ brickwalls.
    Determine the thickness (t) of the waist-slab and use USD (with $\rho_s = 0.25\rho_{max}$) to calculate the
    (i) allowable live load on the staircase if FF = 25 psf,
    (ii) required reinforcements in the slab (and show them with neat sketch).

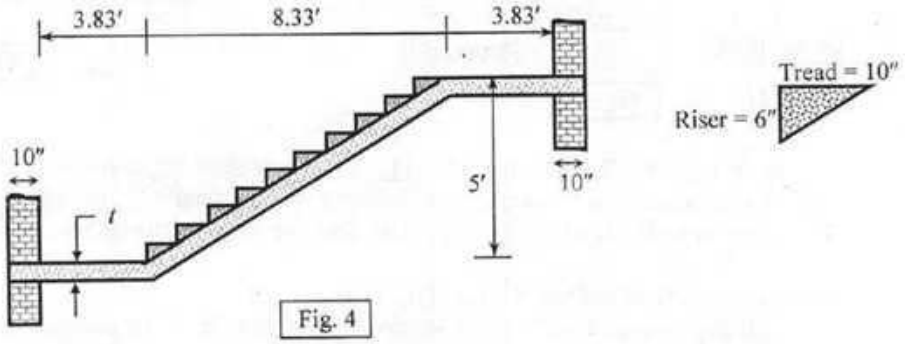


Fig. 4

PART B

[Answer **any 3 (three)** of the following 4 questions]

Full Marks: 30 [= 3 × (5 + 5)]

11. (i) What is a 'transformed' RC section? Explain with reference to cracked and uncracked sections.
    (ii) Why does the ACI recommend that in WSD, the value of compressive stress in steel (f_s') be taken as twice the value calculated from elastic analysis?

12. (i) What are the components of concrete shear resistance (V_c) of RC beams?
    (ii) Explain the effects of Web Reinforcement on the shear resistance of RC beams.

13. (i) Mention the distinctive features of the shear design of deep beams.
    (ii) Explain why shear reinforcements are usually not provided in the design of RC slabs.

14. (i) What is development length of reinforcing bars?
    Mention the factors influencing development length of deformed bars in tension.
    (ii) Explain why the development length of compression bars is smaller than that of tension bars.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures II — Course Code: CE 317
Time: 3 hours — Full Marks : 100

Answer any SIX Questions out of EIGHT

1. For the two-way edge supported slabs (t = 6") shown in Fig. 1 the coefficients for middle strip mid-span and support moments are given. Design the slabs. Calculate the required reinforcements and show them in neat sketches (Draw plan and sections showing all the reinforcements). Floor Finish (FF) = 30 psf; Live Load (LL) = 80 psf.

   Given $t = 6"$, $k = 0.378$, $j = 0.88$; $f_s = 24$ ksi; $f_y = 60$ ksi; $n = 9$,
   $+C_{A(DL)} = 0.027$, $+C_{A(LL)} = 0.032$, $-C_A = 0.071$,
   $+C_{B(DL)} = 0.033$, $+C_{B(LL)} = 0.035$, $-C_B = 0.0$

2. A circular column carries a working DL = 800^k and LL = 500^k. Design the spiral column using reasonable percentage of main reinforcement by USD. Given $f'_c = 4$ ksi, $f_y = 60$ ksi, $f_s = 24$ ksi, $n = 9$. Design spirals also.

3(a) Write down the design criteria of a RC footing for a RC column. If the footing is rectangular what are the ways in providing the bars in short direction. Discuss with sketches.

(b) The part plan of a building as shown in Fig. 2 consists of columns A, B, C and D carrying axial loads of 500^k, 800^k, 700^k and 1000^k respectively. Fix the overall size of one combined footing for all the columns. Allowable bearing capacity = 5 ksf. column sizes 24" × 24" (each). Make a layout of the combined footing completely.

4. A 32" column carries a working DL = 1000^k and LL = 700^k. 16" × 16" square precast piles shall be provided for the column. The allowable load carrying capacity of each pile = 120^k. Pile spacing shall be 3 times the least dimension of pile i.e. 4 ft. c/c each direction. Design the pile cap by USD. Make neat sketches (plan and section) showing all the reinforcements and necessary details.
   Given: $f'_c = 3.5$ ksi, $f_y = 60$ ksi, $n = 9$.

5. A column section with the reinforcements is shown in Fig. 3. Draw the interaction diagram for the column with at least five points corresponding to tension, compression and balanced failure conditions. Use USD.
   Given: $f'_c = 4$ ksi, $f_y = 60$ ksi, $n = 9$.

6(a) Why does ACI recommend to design a rectangular slab supported on all sides as a one way slab if the side ratio of the slab is more than 2. Justify your answer with mathematical logic.

(b) A combined footing supporting two columns 'A' and "B" (with working loads as given) is shown in Fig. 4. Effective depth of the footing is 38".
   i) Check the adequacy against punching shears.
   ii) Design the transverse beams under the columns. Use either WSD or USD.
   Given $f'_c = 4$ ksi. $f_y = 60$ ksi, $n = 9$

7(a) A plan and section of a 5-storied building on beams and columns are shown in Fig. 5. All the beams in all floors are 12″×24″ including slab.
Slab thickness in all floors = 6½ ″
Average lime concrete (LC) on roof = 30 psf
Live load on roof = 20 psf
Floor finish (FF) on each floor = 30 psf
Random wall load on each floor = 40 psf
Live load (LL) on each floor = 80 psf
Given f'_c = 3 ksi, f_y = 60 ksi, n = 9.
Design an interior column section for the load to be calculated.

(b) For the interior column design a square footing if the allowable bearing capacity of soil is 3.5 ksf. Given f'_c = 3 ksi, f_y = 60 ksi, n = 9.

8(a) A cross section of a retaining wall is shown in Fig. 6. The vertical component of the reaction, R_v is 29^k and it acts at a distance of 7.5 ft from the toe as shown in the same figure. Design the reinforcement for the footing of the retaining wall. γ_{soil} =100 #/cft, f'_c = 3 ksi, f_y = 60 ksi, n = 9.

(b) Show the ties as per ACI Code for the following column sections. All main bars shown are 1 inch dia. (Fig. 7)

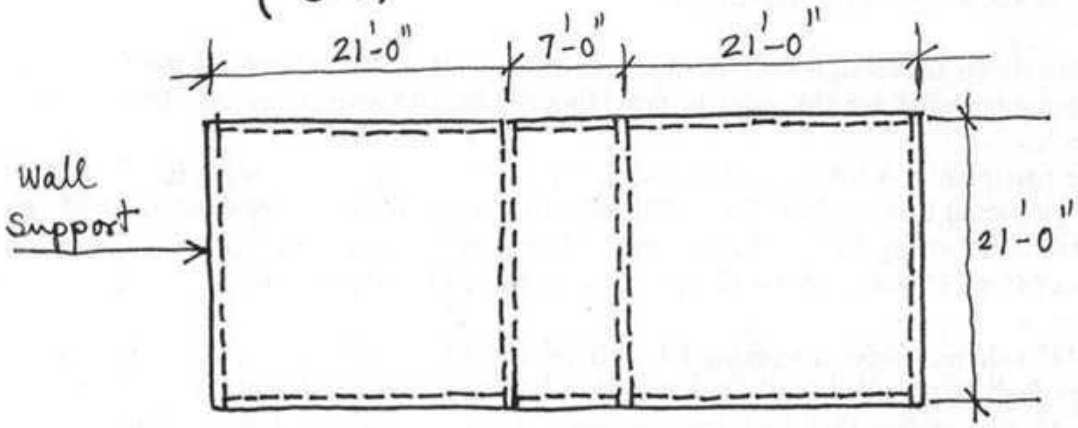
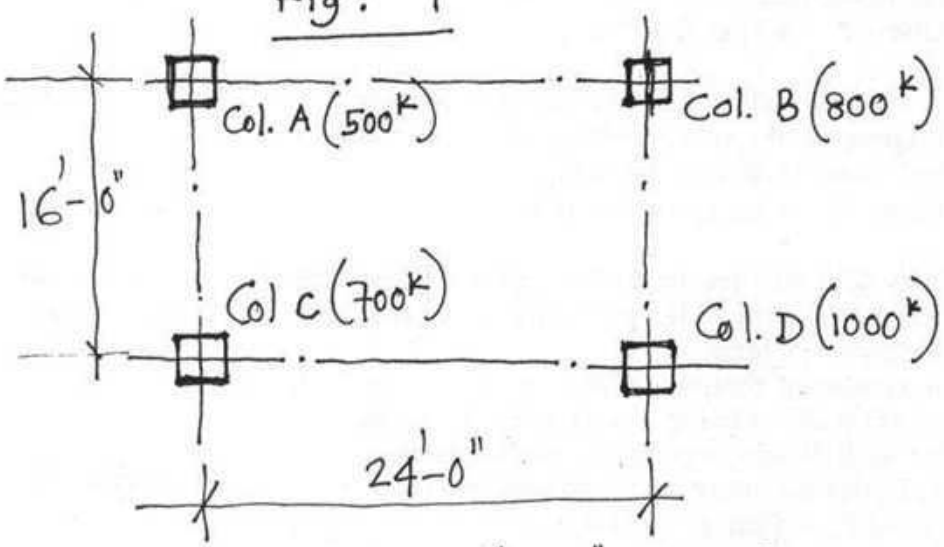


Fig. 1



ALL COLUMNS 24" × 24" IN SIZE
ALL LOADS (TOTAL UNFACTORED)

Fig. 2

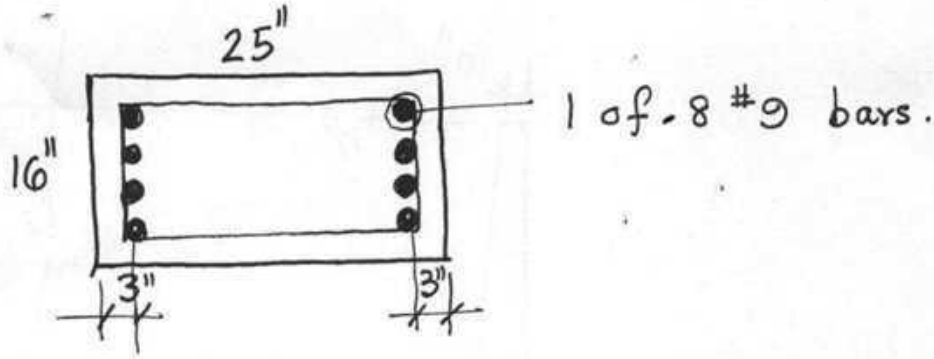


Fig. 3

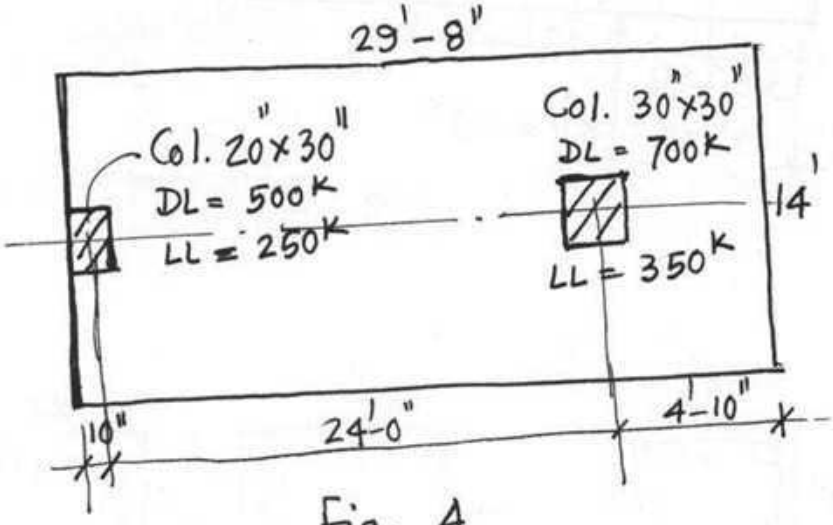
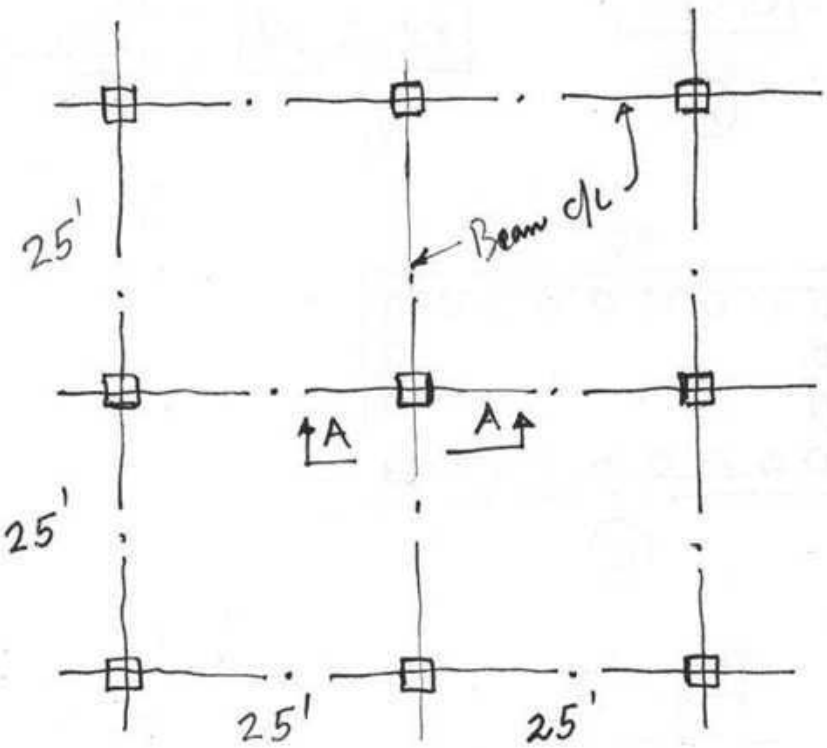
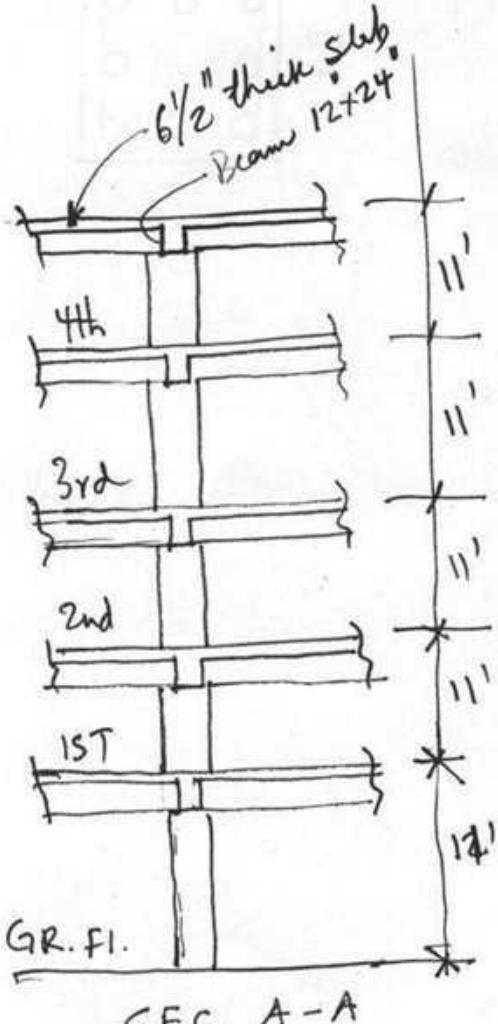


Fig. 4



PART FLOOR PLAN



SEC A-A

Fig. 5

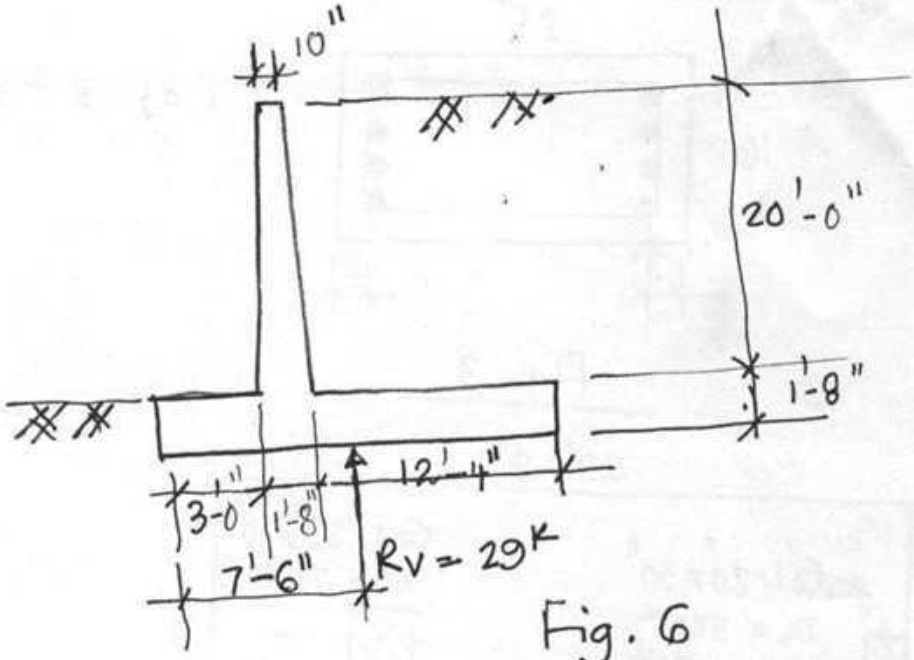


Fig. 6

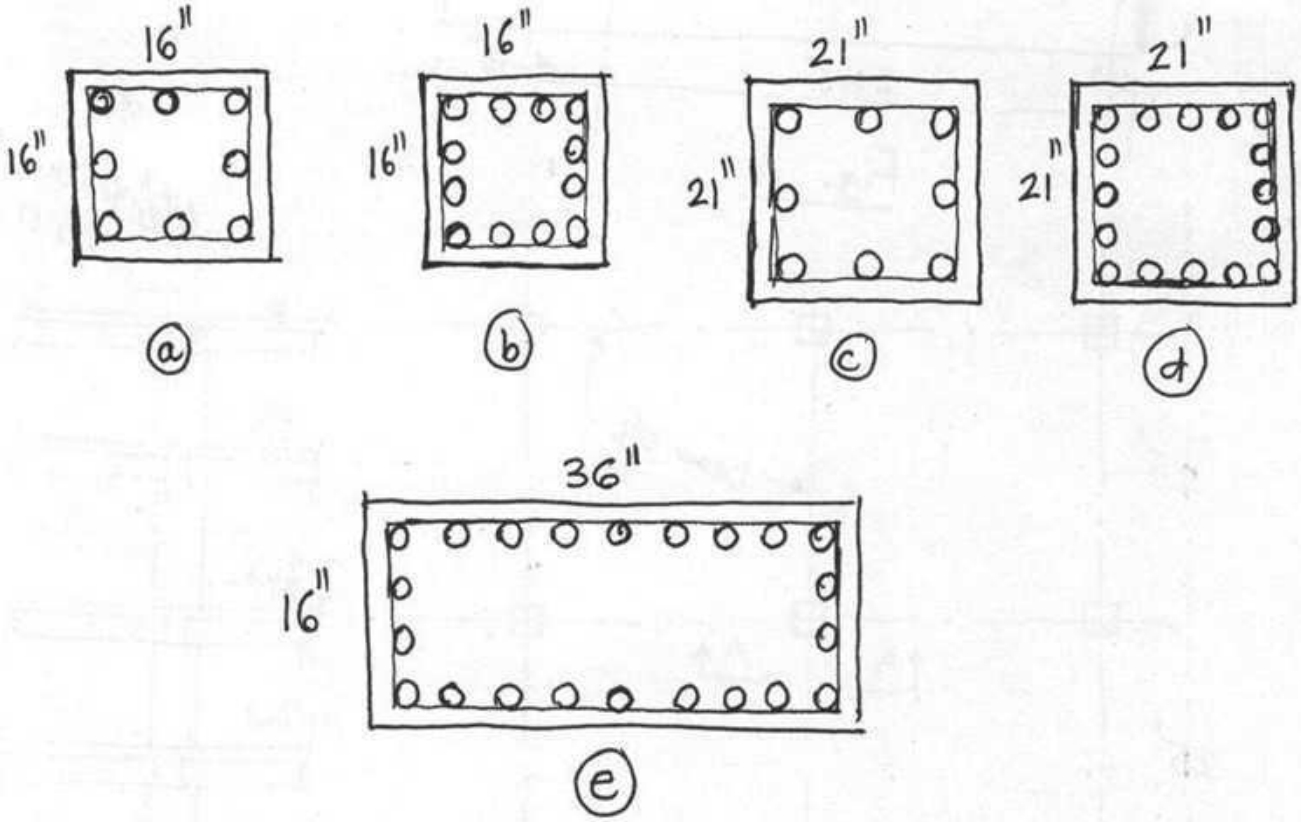


Fig. 7

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering I — Course Code: CE 331
Time- 3 hour — Full marks: 100

(SEC- A)

Answer any five questions out of six. Assume any missing data.

1. (a) Define potable and palatable water. (3)

   (b) Explain the principle of iron removal. (6)

   (c) Define confined and unconfined aquifer with figure. (4)

   (d) For water supply of a small town, water is required to be pumped from a tubewell to an overhead tank. Work out the capacity of the pump and the motor. (7)
   Daily requirement of water = 550000 litres
   Hours of daily pumping = 6
   Height of CL of pump above ground level = 0.75 m
   Water table below ground level = 9 m
   Fluctuations in the water table at different periods = 2 m
   Maximum depression on the pumping level = 3 m
   Height of the tank above ground level = 13.5 m
   Maximum depth of water in the tank = 2 m
   Height of the inlet above the maximum water level = 0.25 m
   Loss of head in the pump and rising main = 1.5 m
   Efficiency of the pump= 65%
   Efficiency of the motor = 80%

2. (a) Differentiate between slow sand filter (SSF) and rapid sand filter (RSF). (6)

   (b) Classify pumps on the basis of different service. (2)

   (c) Write down the important considerations for selection of site for intake structures. (7)

   (d) Explain why continuous method water supply is better than intermittent method. (5)

3. (a) Water is supplied from an impounding reservoir 20 miles away to a service reservoir near the town. A cast iron main is to be designed to supply 400 mgd. Loss of head due to friction in the pipe is estimated to be 200 ft. All the other head losses are neglected. Find the size of the cast iron pipe? (7)

   (b) Classify distribution network with appropriate figure. (6)

   (c) Draw and explain the Break Point Chlorination curve. (4)

(d) What are the problems of groundwater development in Bangladesh? (3)

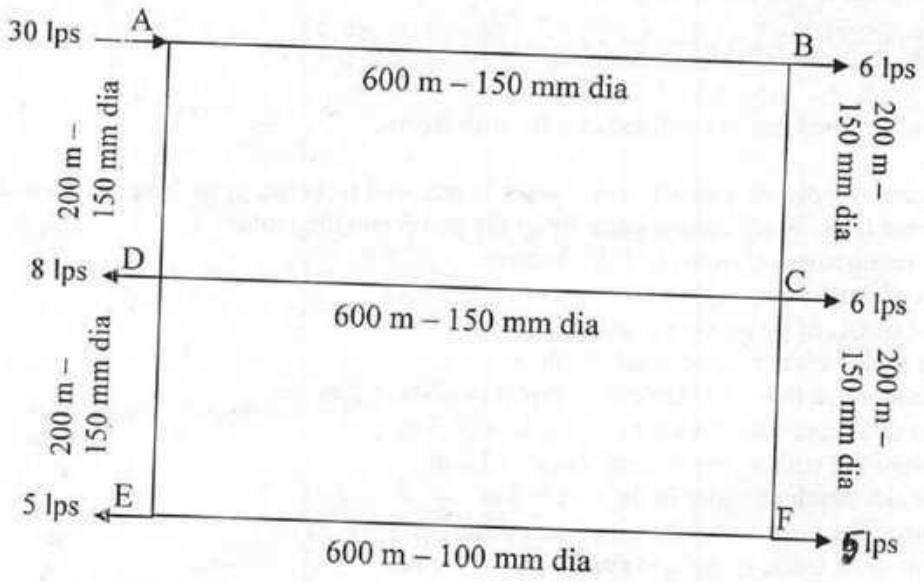
4. (a) Briefly explain the theories of filtration. (12)

(b) Determine peak design flow for 15000 people when the peak factor is 2.0, average water consumption is 135 litre/day with a wastage of 20%. (3)

(c) Briefly explain iron removal plan with sketch. (5)

5. (a) What are factors needed to be considered in determining the location of intake? (4)

(b) Calculate the flow in each of the pipes in the following looped pipe network: (16)



6. (a) Name different methods for removing hardness from water. Briefly explain two of them. (5)

(b) Determine settling velocity for a design flow of 450000 ft^3/day, ρ_s = 155 lb/ft^3, ρ_w = 62.4 lb/ft^3, diameter is 0.008 inch, viscosity 0.000672 lb/ft.s. (3)

(c) Explain any four of the following: (4X3)

i. Coagulation and flocculation
ii. Disinfection
iii. Sanitary significance of fluoride
iv. Sanitary significance of nitrate
v. Greywater

(SEC-B)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering I — Course Code: CE 331
Time- 3 hour — Full marks: 100

Question No. 1 is compulsory. Answer FOUR from the rest.
(Note: Assume any missing data)

1. (a) Design a tube well of a suitable aquifer for extracting drinking water at a depth from 280 ft to 340 ft. (24)
(Summary of grain size test report, gradation chart & all relevant data are given below).

2. (a) Write explanatory notes on the following: (any three) (9)
i. Porosity & permeability of soil ii. Fire demand iii. Water use and re-use iv. Artificial groundwater recharges v. plain sedimentation

(b) Write down the considerations for planning and design of a low - cost water supply scheme in developing countries. (6)

(c) A rapid sand filter is to be designed for a capacity of 27,000 m^3/day. What should be the number and size of the units ? Calculate the percentage of filtered water required to wash the filter bed and the capacity of the wash water tank. (4)

[Assume : Rate of filtration : 5 $m^3/hr/m^2$
Rate of washing : 35$m^3/hr/m^2$
Length of the filter run : 24 hrs including 8 min. for filter washing and 12 min. for resettlement of sand bed.]

3. (a) Write down the installation procedure of tubewells. (7)

(b) Differentiate between the pressure pipes and gravity pipes. (3)

(c) Write down the purpose of pumps and pumping machinery in the water supply. (4)

(d) The velocity of water flowing from a reservoir into a 1m dia steel pipe is 2 m/sec. If a valve is situated in the pipe-line at a point 2 km from the reservoir , evaluate water hammer pressure developed by the closure of this valve, if (5)
I. The closure time is 3 sec
II. The closure time is 5.5 sec

The thickness of the pipe –shell may be taken to be 2.5 cm.

4. (a) Define intake structures. (2)

(b) Write down the important considerations for selection of site for intake structures. (6)

(c) What are the main types of water distribution networks ? What are their relative advantages and disadvantages ? (7)

(d) A 100 mm diameter tubewell is sunk to withdraw water from a 10 m thick confined aquifer having coefficient of permeability equal to 0.75 lps/m^2 . The depth of water below the peizometric level is 30m and it falls 2m in the tube well while pumping. Calculate the discharge of the tube well when the radius of the circle of influence is 30m. (4)

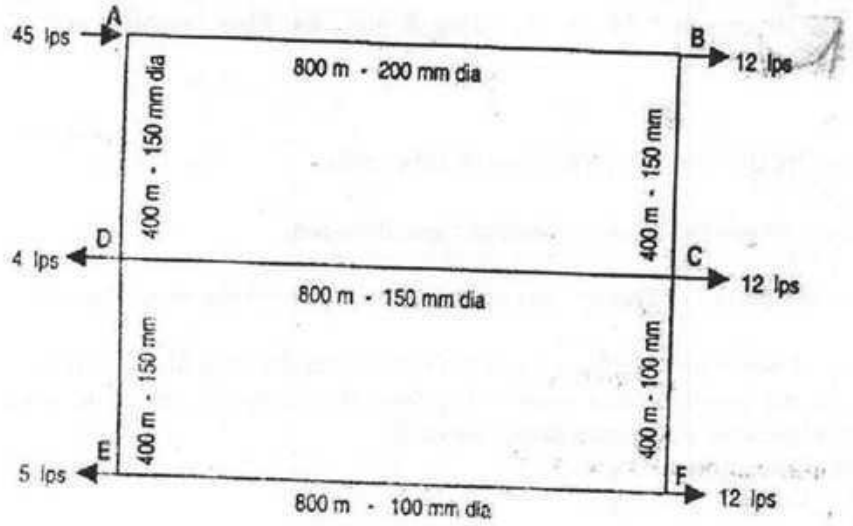
5. (a) Draw and explain the break point chlorination. (4)

(b) Write down the technologies for removal of hardness of water and discuss briefly all of them. (10)

(c) One million gallons of water per day (1 mgd) passes through a sedimentation tank which is 20 ft. wide, 50 ft. long and 10 ft deep. (a) Find the detention time for this basin, (b) what is average velocity of flow through the basin ? (c) If the suspended solids content of the water average 40 ppm, what weight of dry solids will be deposited every 24 hrs assuming 75% removal in basin. (d) What is over flow rate ? (5)

6. (a) At present rainwater harvesting is potential alternate source of water supply in Bangladesh. Discuss. (7)

(b) Calculate the flow in each of the pipes in the following looped pipe network: (12)



The necessary equations are given below:

1. $U_P = \sqrt{(E_W/\rho)}.\ 1/\sqrt{(1+ E_W/E_P.d/t)}$ 2. $P_h = P_h(max)\ (T_C/T)$ 3. $T_C = 2S/U_P$

4. $\Delta = -\sum H /(x \sum H/ Q_a)$

Where, Δ = flow correction; Q_a = assumed flow; H = Head loss and x= component equal to 1.85 for Hazen William s equation and 2 for Manning equation.

5. **Summary of Grain Size Test Results:**

Sample depth	D_{10}	D_{30}	$U= D_{60}/D_{10}$	% of Coarse Sand	% of Medium Sand	% of Fine Sand	FM
(ft)	mm	mm		%	%	%	
240	0.17	0.25	1.4	0.5	89.5	20	1.5
260	0.18	0.24	1.46	0.5	89.5	20	1.49
280	0.2	0.3	1.3	4	86	10	**1.68**
300	0.15	0.24	1.58	12	68	20	**1.60**
320	0.18	0.25	1.52	2	82	16	**1.56**
340	0.18	0.27	1.11	10	75	15	**1.67**
360	0.15	0.22	1.55	1	76	23	1.38
380	0.16	0.21	1.38	0.5	75	24	1.30

The relevant size of sieve No.

Seive No.	Size (mm)
4	4.75
8	2.36
16	1.18
30	0.6
40	0.425
50	0.3
100	0.15
200	0.075

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering I — Course Code: CE 331
Time- 3 hour — Full marks: 100

(SEC-B)

Question No. 1 is compulsory. Answer FOUR from the rest.
(Note: Assume any missing data)

1. (a) Design a tube well of a suitable aquifer for extracting drinking water at a depth from 280 ft to 340 ft. (24)
(Summary of grain size test report, gradation chart & all relevant data are given below).

2. (a) Write explanatory notes on the following: (any three) (9)
i. Porosity & permeability of soil ii. Fire demand iii. Water use and re-use iv. Artificial groundwater recharges v. plain sedimentation

(b) Write down the considerations for planning and design of a low - cost water supply scheme in developing countries. (6)

(c) A rapid sand filter is to be designed for a capacity of 27,000 m^3/day. What should be the number and size of the units ? Calculate the percentage of filtered water required to wash the filter bed and the capacity of the wash water tank. (4)

[Assume : Rate of filtration : 5 $m^3/hr/m^2$
Rate of washing : $35m^3/hr/m^2$
Length of the filter run : 24 hrs including 8 min. for filter washing and 12 min. for resettlement of sand bed.]

3. (a) Write down the installation procedure of tubewells. (7)

(b) Differentiate between the pressure pipes and gravity pipes. (3)

(c) Write down the purpose of pumps and pumping machinery in the water supply. (4)

(d) The velocity of water flowing from a reservoir into a 1m dia steel pipe is 2 m/sec. If a valve is situated in the pipe-line at a point 2 km from the reservoir , evaluate water hammer pressure developed by the closure of this valve, if (5)
I. The closure time is 3 sec
II. The closure time is 5.5 sec

The thickness of the pipe –shell may be taken to be 2.5 cm.

4. (a) Define intake structures. (2)

(b) Write down the important considerations for selection of site for intake structures. (6)

(c) What are the main types of water distribution networks ? What are their relative advantages and disadvantages ? (7)

(d) A 100 mm diameter tubewell is sunk to withdraw water from a 10 m thick confined aquifer having coefficient of permeability equal to 0.75 lps/m^2 . The depth of water below the peizometric level is 30m and it falls 2m in the tube well while pumping. Calculate the discharge of the tube well when the radius of the circle of influence is 30m. (4)

5. (a) Draw and explain the break point chlorination. (4)

(b) Write down the technologies for removal of hardness of water and discuss briefly all of them. (10)

(c) One million gallons of water per day (1 mgd) passes through a sedimentation tank which is 20 ft. wide, 50 ft. long and 10 ft deep. (a) Find the detention time for this basin, (b) what is average velocity of flow through the basin ? (c) If the suspended solids content of the water average 40 ppm, what weight of dry solids will be deposited every 24 hrs assuming 75% removal in basin. (d) What is over flow rate ? (5)

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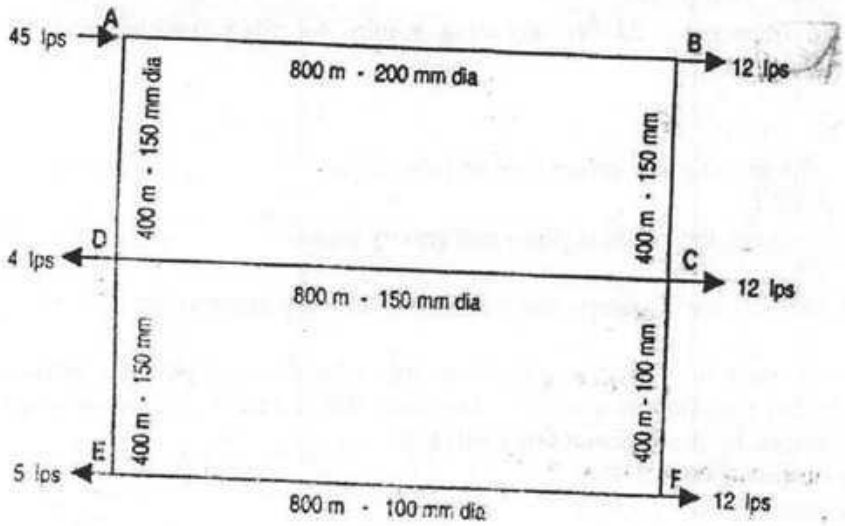

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5. **Summary of Grain Size Test Results:**

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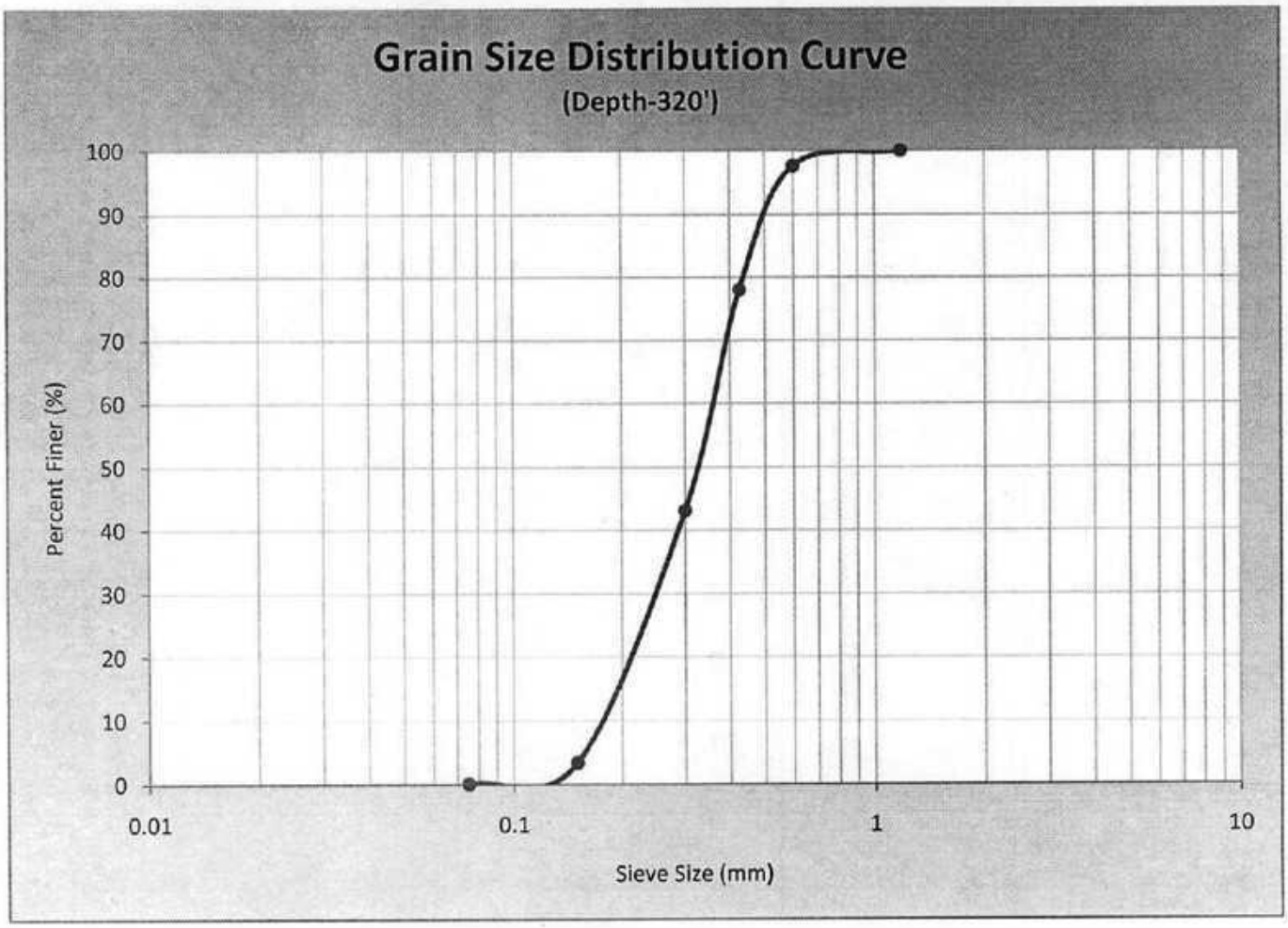
8	2.36
16	1.18
30	0.6
40	0.425
50	0.3
100	0.15
200	0.075

Note: Complete and attach the gradation chart with the exam paper.



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering I — Course Code: CE 331
Time- 3 hour — Full marks: 100

(SEC- A)

Answer any five questions out of six. Assume any missing data.

1. (a) Define potable and palatable water. (3)

   (b) Explain the principle of iron removal. (6)

   (c) Define confined and unconfined aquifer with figure. (4)

   (d) For water supply of a small town, water is required to be pumped from a tubewell to an overhead tank. Work out the capacity of the pump and the motor. (7)
   Daily requirement of water = 550000 litres
   Hours of daily pumping = 6
   Height of CL of pump above ground level = 0.75 m
   Water table below ground level = 9 m
   Fluctuations in the water table at different periods = 2 m
   Maximum depression on the pumping level = 3 m
   Height of the tank above ground level = 13.5 m
   Maximum depth of water in the tank = 2 m
   Height of the inlet above the maximum water level = 0.25 m
   Loss of head in the pump and rising main = 1.5 m
   Efficiency of the pump= 65%
   Efficiency of the motor = 80%

2. (a) Differentiate between slow sand filter (SSF) and rapid sand filter (RSF). (6)

   (b) Classify pumps on the basis of different service. (2)

   (c) Write down the important considerations for selection of site for intake structures. (7)

   (d) Explain why continuous method water supply is better than intermittent method. (5)

3. (a) Water is supplied from an impounding reservoir 20 miles away to a service reservoir near the town. A cast iron main is to be designed to supply 400 mgd. Loss of head due to friction in the pipe is estimated to be 200 ft. All the other head losses are neglected. Find the size of the cast iron pipe? (7)

   (b) Classify distribution network with appropriate figure. (6)

   (c) Draw and explain the Break Point Chlorination curve. (4)

(d) What are the problems of groundwater development in Bangladesh? (3)

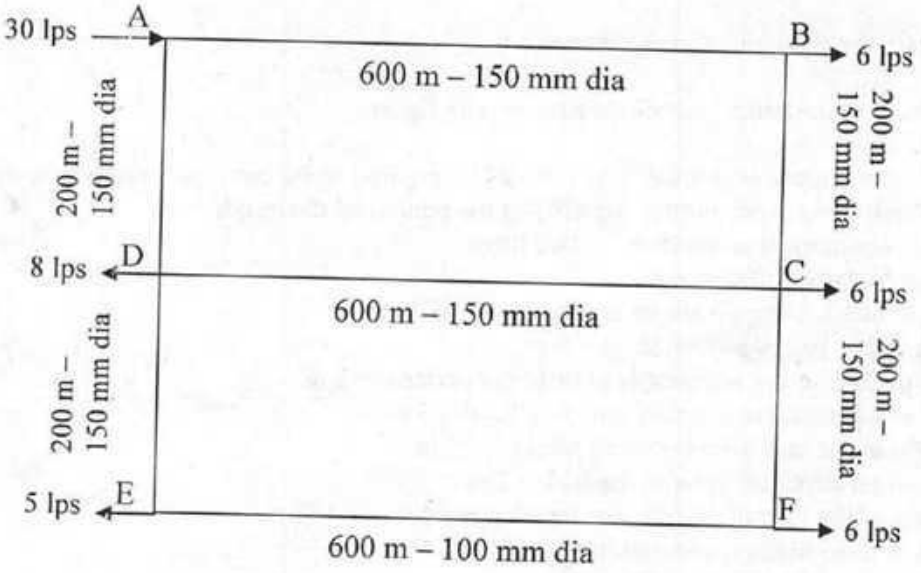
4. (a) Briefly explain the theories of filtration. (12)

(b) Determine peak design flow for 15000 people when the peak factor is 2.0, average water consumption is 135 litre/day with a wastage of 20%. (3)

(c) Briefly explain iron removal plan with sketch. (5)

5. (a) What are factors needed to be considered in determining the location of intake? (4)

(b) Calculate the flow in each of the pipes in the following looped pipe network: (16)



6. (a) Name different methods for removing hardness from water. Briefly explain two of them. (5)

(b) Determine settling velocity for a design flow of 450000 ft^3/day, ρ_s = 155 lb/ft^3, ρ_w = 62.4 lb/ft^3, diameter is 0.008 inch, viscosity 0.000672 lb/ft.s. (3)

(c) Explain any four of the following: (4X3)

i. Coagulation and flocculation
ii. Disinfection
iii. Sanitary significance of fluoride
iv. Sanitary significance of nitrate
v. Greywater

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II | Course Code: CE 333
Time: 3.0 hours | Full Marks:100(=5×20)

[Answer any 5 (Five) of the following 6 questions]

[Assume any data, if missing]

1. (a) Draw a lateral section of a typical imhoff tank. 4
   (b) Draw operational flow diagram of Pagla Sewage Treatment Plant? 3
   (c) What problem arises if water hyacinth grows in stabilization pond? 2
   (d) Write some relative advantages of activated sludge over trickling filters? 4
   (e) In a certain day, by which time, DO concentration becomes minimum in a natural water body? Why? 3
   (f) Calculate the sludge volume index (SVI) for a mixed liquor with 2,500 mg/L of suspended solid when a liter of such mixed liquor produces 190 mL of sludge when settles down. 4

2. (a) Explain Marai's theorem for efficiency of pond system. 5
   (b) Why optimum retention period is considered as 5 days in an anaerobic pond? 2
   (c) What measures are taken for odor control in anaerobic pond? 2
   (d) What are the most commonly used depth for different stabilization ponds? 2
   (e) Design a facultative pond to treat 8,000 m^3/d of domestic sewage with a BOD_5 of 560 mg/L and Faecal Coliform of 3×10^7 FC/100 mL. The design temp is 20°C and the required effluent standards are: $BOD_5 < 50$ mg/L, FC < 5000/100 mL. Assume the values of k_b and k as 2.3 d^{-1} and 0.2 d^{-1} respectively. If you find the design isn't satisfactory with the given data, then recommend some steps which can produce an acceptable design. 9

3. (a) Define Sewer, Sewage, Sewerage and Sullage. 4
   (b) Briefly explain the salient features of Hydraulic Element Diagram. 3
   (c) Calculate the wastewater quantity (m^3/day) of a small town of 70,000 inhabitants. The average water consumption is 140 l/day/capita. A small factory locates in the town, has a daily production capacity of 7000 kg. Each kg produced wastewater in average as much as 1.6 inhabitants. A hotel along with other commercial area occupied 210 ha producing 1.0 l/sec/ha wastewater. 5
   (d) Design a simple pit latrine for a family of 10 persons for a design life of 4 years. GWT is 3.5 m below ground surface. After using the latrine for 1.5 years, the users want to upgrade the latrine into an off-set pit latrine (similar to ROEC) so that the same pit can be used repeatedly with regular desludging. Determine total life of the pit as an off-set pit before emptying for the first cycle. 8

4. (a) Which type of bacteria is important in sewage treatment and why? 2
(b) Draw typical bacterial growth pattern and indicate different phases. 5
(c) Compare BOD with COD. 4
(d) Draw graph to show BOD exertion as a function of reaction constant. 3
(e) The BOD_5 of wastewater is determined to be 150 ppm at 20°C. Determine its BOD values for 8-day 30°C and 10-day 15°C. Assume k_1 (20°C) = 0.23 per day. 6

5. (a) Why zoning is required for water supply for tall building? Mention different zones. 3
(b) Which type of zoning is generally considered for water supply pipe design in Dhaka city? Why? 4
(c) How layout of water supply pipe differs with sewerage pipe in Dhaka city? 4
(d) What do you mean by flush valve and flush tank fixtures? 3
(e) Calculate the maximum height of a building for direct supply of water from the following data: 6
- 9.5 ft floor to floor height
- Service main pressure = 50 psi
- Pressure loss in the water meter = 3.5 psi
- Pressure loss in the pipes and fittings = 5.5 psi
- Max. Fixture pressure 8 psi
- Min. Fixture pressure 3 psi
- Max. Fixture pressure is not to be exceeded 40 psi

Assume reasonable value of any missing data, if required.

6. (a) What are the methods of disposal for sewage effluent on land by irrigation? 2
(b) Mention the methods commonly known as to contribute O_2 to surface water. 2
(c) Describe zone of recovery as a stage of water pollution and self purification. 4
(d) A city discharges 105,000 m^3/d of sewage into a stream whose minimum rate, of flow is 7.5 m^3/s. The velocity of stream is 2.3 km/h. The temperature of the sewage is 20°C and that of the water of stream is 15°C. The 20°C BOD_5 of the sewage is 190 mg/l and that of the stream water is 1 mg/l. The sewage contains no DO while the stream is 90% saturated with dissolved oxygen (saturated DO at 15°C is 10.2 mg/l). The values of K_1 and K_2 at 20°C are 0.25/d and 0.65/d respectively. Determine - 12
(i) The critical oxygen deficit, critical (minimum) DO and its location.
(ii) Sketch the DO profile for a 80-km reach of the stream below the discharge.

Formula:

$$N_e = \frac{N_i}{(1+k_b t_1)(1+k_b t_2)....(1+k_b t_n)} \qquad \lambda_s = \frac{10\, L_i\, Q}{A} \qquad \frac{L_e}{L_i} = \frac{1}{1+k_1 t}, \qquad \lambda_{s(all)} = 20T - 120$$

$$A = \frac{Q}{DK}\left(\frac{L_i}{L_e} - 1\right) \qquad D_t = \frac{K_1 L_a}{K_2 - K_1}\left(e^{-K_1 t} - e^{-K_2 t}\right) + D_a e^{-K_2 t}, \qquad A = \frac{Qt}{D} \qquad D_c = \frac{K_1}{K_2} L_a e^{-K_1 t_c}$$

$$K_{1(T)} = K_{1(20)} \times (1.047)^{T-20} \qquad t_c = \frac{1}{K_2 - K_1} \ln\left\{\frac{K_2}{K_1}\left(1 - \frac{D_a (K_2 - K_1)}{K_1 L_a}\right)\right\} \qquad K_{2(T)} = K_{2(20)} \times (1.016)^{T-20}$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc Engineering (Civil)

Course Title: Transportation Engineering I (Transport and Traffic Design) Course Code: CE 351
Time: 3 hrs Full Marks: 150

Answer any 5 out of 7 questions

1. Consider the following spot speed data, collected from a freeway site operating under free-flow conditions: (30)

Speed Group (mi/h)	Number of vehicles observed (N)
15-20	0
20-25	3
25-30	6
30-35	18
35-40	45
40-45	48
45-50	18
50-55	12
55-60	4
60-65	3
65-70	0

(i) Plot the frequency and cumulative frequency curves for these data.
(ii) Calculate the common descriptive statistics.

2. Draw the diagrams for the speed-flow-density relationship. Assume that a speed density study has resulted in the following calibrated relationship: (30)

$S = 55.0 - 0.45D$

Derive the speed-flow and flow-density relationship from it. Also, calculate the free flow speed, jam density and capacity of the traffic stream.

3. (a) If a highway curve with a radius of 800 ft has a super elevation rate of 6% then what will be the maximum safe operating speed on that? (10)

(b) An accident investigator estimates that a vehicle hit a bridge abutment at a speed of 20 mph based on his assessment of damage. Leading up to the accident location, he observes skid mark of 100 ft on the pavement and 75 ft on the grass shoulder. There is no grade. Estimate the speed of the vehicle at the beginning of the skid mark. Use F = 0.35 and 0.25, for the two surface conditions (use your judgment to select the value). (20)

4. (a) What will be the safe stopping distance of a rural freeway with a design speed of 70 mph on a section of level terrain? Assume any other missing data. (15)

(b) Explain with mathematical examples (15)
i)Trip distribution (Gravity Model)

5. You have been asked to conduct a traffic volume study for the location of a Dhaka city. You have decided to collect data for 3 days due to budget constraints. Generate hypothetical data and mathematically demonstrate how you will conduct the study. Also specify how many people will be needed for your study. (30)

6. (a) Draw the cross sections of 5 types of guard rails and mention where these can be applicable. (15)
   (b) What is PCE? Give a mathematical example to demonstrate its use in Traffic Engineering. (15)

7. (a) What is DDHV? What are "K" and "D" factors? What will be there typical values for urban areas? What is PHF? What will be its theoretical maximum and minimum values? Demonstrate mathematically. (15)
   (b) What is perception-reaction time? (5)
   (c) Draw a spiral curve and show its different elements. (10)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title: Open Channel Flow | Course Code: CE 361
Time: 3 Hrs | Full Marks: 90

[There are six (8) questions. Answer any five (6)]

1	(a)	Define Specific Energy and Total Energy.	(4)
	(b)	Write down the various uniform flow formulae.	(6)
	(c)	For a trapezoidal channel with b= 6 m and s = 2, compute the critical depth and velocity if Q = 50 m^3/s.	(5)
2	(a)	Define 'hydraulic jump' and 'Regime' approach of an open channel.	(4)
	(b)	Classify the hydraulic jumps based on Froude number.	(4)
	(c)	A horizontal trapezoidal channel with b = 6 m and s = 2 carries a discharge of 120 m^3/s. If the upstream depth of flow is 1 m, compute the downstream depth that will create a hydraulic jump.	(7)
3	(a)	Define Sequent depth and establish the sequent depth formula for a horizontal rectangular channel.	(7)
	(b)	A concrete lined channel is to carry a discharge of 100 m^3/s and laid on a slope of 1 in 2500. The side slope of the channel is 1:1 and the value of n = 0.012. Determine the section dimensions if the permissible velocity is 2 m/s.	(6)
	(c)	Define lining.	(2)
4	(a)	What is flow measurement device? What are the criteria on which the choice of construction material depends?	(5)
	(b)	Derive the discharge formula for broad crested weir for free flow condition.	(7)
	(c)	A rectangular broad crested weir spanning the full width of a rectangular channel 2 m wide. Compute the discharge over the weir under an upstream head of 0.75 m. The coefficient of discharge C_d is 0.67.	(3)
5	(a)	Design a stable channel by using the Lacey's theory. The channel is to carry 10 m^3/s through 1 mm diameter sand.	(6)
	(b)	What are the differences between sharp crested and broad crested weirs?	(3)
	(c)	Obtain the relationship among Chezy's C, Darcy-Weishbach friction factor f and Manning's n.	(6)
6	(a)	Draw a schematic diagram of a Parshall flume. What are the advantages of flumes over the weirs?	(3)
	(b)	Water flows in a horizontal rectangular channel 6 m wide and at a depth of 0.52 m and a velocity of 15.2 m/s. Check whether hydraulic jump forms in this channel or not. If forms, determine, (i) type of jump, (ii) downstream depth needed to form jump, and (iii) relative height of jump and (iv) length of jump.	(8)
	(c)	What are the various factors affecting the Manning's roughness coefficient, n?	(4)
7	(a)	Define Normal depth and Conveyance of an open channel.	(4)
	(b)	For a rectangular channel with bottom width b = 6 m, n = 0.025 and bottom slope S_0 = 0.0025, compute the normal depth and velocity if Q = 20 m^3/s.	(6)
	(c)	What are the conditions for establishing uniform flow in an open channel?	(5)
8	(a)	Write down design steps for a lined trapezoidal channel with appropriate figure.	(5)
	(b)	Draw a schematic diagram of a broad crested weir and state the conditions to be satisfied to exist the hydrostatic pressure distribution.	(4)
	(c)	The sides of a laboratory flume are made of glass (n = 0.01) and the bottom is made of wood (n = 0.015). The flume is rectangular with b = 1 m and is laid on a slope of 0.001. Compute the discharge in the flume if normal depth, h_n = 0.04 m.	(6)

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2012
Program: B. Sc Engineering (Civil)

Course Title: Engineering Hydrology Course Code.: CE 363 Credit hrs: 3
Time: 3 hours Full Marks: 150

Part A
There are FOUR questions answer any THREE

1. (a) Explain the following (any Three): (9)
   i) Depth-duration-frequency curve
   ii) Infiltration capacity
   iii) Rational method to estimate the magnitude of a flood peak
   iv) Consistency test for rainfall records
   v) Pan coefficient

   (b) Distinguish between the following (any Four): (8)
   i) Depression storage and interception
   ii) Field capacity and permanent wilting point
   iii) Hydraulic and hydrologic method of flood routing
   iv) Cold and warm fronts
   v) Storm hydrograph and direct runoff hydrograph

   (c) At a climate station, the following measurements are made: air pressure=101.1 kPa, air temperature = 25^0C, and dew point temperature = 20^0C. Calculate the corresponding vapor pressure, relative humidity, specific humidity and air density. (8)

2. (a) Explain the procedure for (i) checking a rainfall data for consistency and (ii) supplementing the missing rainfall data. (10)

   (b) Seven rain gauges located within a catchment area whose shape can be approximately described by smooth lines joining the following coordinates: (20,30), (15,45), (20,60), (40,85), (60,95), (80,95), (85,90), (75,60), (60,40) and (40,30). Recorded rainfall data are tabulated as below. All co-ordinates are expressed in Km.
   Compute the average rainfall in the area using Thiessen polygon method. (15)

Raingauge Location	Annual Rainfall (cm)
(25, 45)	132
(15, 75)	136
(45, 75)	93
(75, 85)	81
(85, 65)	85
(65, 55)	124
(35, 15)	156

3. (a) Discuss the factors that affect the process of evaporation? (10)

(b) A reservoir had an average area of 20 km^2. In a particular month the mean rate of inflow = 10 m^3/s, outflow = 15 m^3/s, monthly rainfall = 10 cm and increase in storage = 16 million m^3. Assuming the seepage losses to be 1.8 cm, estimate the evaporation in that month. (5)

(c) The following data were collected for a stream at a gauging station. Compute the discharge. (10)

Distance from left water edge (m)	Depth, d (m)	Revolution of current meter kept at 0.6d depth below water surface	Duration (sec)
3	1.4	12	50
6	3.3	29	53
9	5.0	35	56
12	9.0	42	59
15	5.4	32	51
18	3.8	33	53
21	1.8	18	50

Calibration equation of current meter: $v = 0.3N + 0.05$, N = revolutions per seconds, v = velocity, m/s.

4. (a) Discuss the role of the shape, slope and drainage density of a basin affecting the shape of a flood hydrograph. (6)

(b) Rainfall of magnitude 3.8cm and 2.8cm occurring on two consecutive 4-h durations on a catchment of area 27 km^2 produced the following hydrograph of flow at the outlet of the catchment. Estimate the rainfall excess and Φ-index. (7)

Time (hr)	-6	0	6	12	18	24	30	36	42	48	54	60	66
Observed Flow (m^3/s)	6	5	13	26	21	16	12	9	7	5	5	4.5	4.5

(c) The ordinates of 6-hr UH are given below. Derive the ordinates of a 8-hr UH by the S-curve method. (12)

Time (hr)	0	4	8	12	16	20	24	28	32	36	40	44
4-hr UH ordinates (cumec)	0	24	82	159	184	151	103	64	36	17	6	0

Part B

There are FOUR questions answer any THREE

(Assume any reasonable data if not given)

5. (a) What are the assumptions of a unit hydrograph? (3)

(b) A basin has the following parameters: A = 400 km^2, L = 35 km and L_{ca} = 10 km. Assuming C_t = 1.5 and C_p = 0.7 develop a 3-h synthetic unit hydrograph for this basin using Snyder's method. (10)

(c) The ordinates of a 6-h unit hydrograph are as given below: (12)

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66
Ordinate of 6-hr UH (m^3/s)	0	20	60	150	120	90	66	50	32	20	10	0

If two storms, each of 1 cm rainfall excess and 6-h duration occur in succession, calculate the resulting hydrograph of flow. Assume base flow to be uniform at 10m^3/s.

6. (a) How does channel routing differ from reservoir flood routing? What are the factors to be considered in choosing the routing period? (5)

(b) The inflow hydrograph for a reach of a river is given below. Determine the outflow hydrograph using the values of the Muskingum coefficients K=18 and x=0.25 for the reach. 20)

Time (hr)	0	12	24	36	48	60	72	84	96	108
Inflow (cumec)	20	191	249	164	110	82	62	48	32	28

7. (a) Derive the required expression and different steps for reservoir routing. What data are required for reservoir routing? (10)

(b) The storage in the reach of a stream has been studied. The values of x and K in Muskingum equation have been identified as 0.28 and 1.6 days, respectively. If the inflow hydrograph to the reach is as given below, compute the outflow hydrograph. Assume the outflow from the reach at t=0 as 3.5 m^3/s. (15)

Time (hr)	0	6	12	18	24	30
Inflow (cumec)	35	55	92	130	160	140

8. (a) What are the different methods to estimate the magnitude of a flood peak. Explain the rational method of computing the peak discharge. (7)

(b) Flood data statistics of two rivers around Dhaka city are given as below. (18)

River	Length of Records (years)	Mean annual flood (m^3/s)	σ_{n-1}
Buriganga	92	6437	2951
Shitalakhya	54	5627	3360

(i) Estimate the 100 and 1000 year floods for these two rivers by using Gumble's method.

(ii) What are the 95% confidential intervals for the predicted values?

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Project Planning and Management — Course Code: CE 401
Time: 3 hours — Full Marks: 100 (= 20 × 5)

There are SEVEN questions. Answer any FIVE
(Graph sheet should be supplied)

1. (a) A transistor radio company manufactures models A, B, C with the following production data. (10)

Model	Profit Contribution (Tk.)	Weekly Production Requirement	Time (Hours) for a Dozen Units		
			Manufacturing	Assembling	Packaging
A	8	100	3	3	5
B	15	150	4	5.5	8
C	25	75	1	1.5	3

During the forthcoming week, the company was available 150 hours of manufacturing, 200 hours of assembling and 60 hours of packaging time.

Formulate this production scheduling problem as a Linear Programming model.

(b) The following table contains figures on the annual usage and unit costs for a random sample of 12 items. Develop an A-B-C classification for these items. (10)

Item Name	Annual usage	Unit cost (Tk)
1	1000	4300
2	5000	720
3	1900	500
4	1000	710
5	2500	250
6	2500	192
7	400	200
8	500	100
9	200	210
10	1000	35
11	3000	10
12	9000	3

2. (a) Solve the following problem by the Simplex Method: (16)

Maximize $Z = 100x + 200y + 50z$

Subject to
$5x + 5y + 10z \leq 1000$
$10x + 8y + 5z \leq 2000$
$10x + 5y \leq 500$
$x, y, z \geq 0$

(b) Discuss different qualitative forecasting methods.

How is the Delphi Method better than the other methods? (4)

3. (a) Objective function: Maximize $Z = 2x_1 + 3x_2$ (14)

Constraints:

$$-x_1 + 2x_2 \leq 16$$
$$x_1 + x_2 \leq 24$$
$$x_1 + 3x_2 \geq 45$$
$$-4x_1 + 10x_2 \geq 20$$
$$x_1, x_2 \geq 0$$

Find the

(i) Optimum value of x_1 and x_2 by graphical method.

(ii) Maximum profit.

(iii) Range of optimality for coefficient of x_1 and x_2 in the objective function.

(b) Assign the tasks (1 to 5) to the employees (A to E) such that each employee will be assigned by only one job to minimize the total cost. (6)

Find at least two multiple solutions if there is any.

		Tasks				
		1	2	3	4	5
Employees	A	10	9	9	18	11
	B	13	9	9	18	11
	C	3	2	4	18	10
	D	18	9	12	17	11
	E	11	11	14	18	13

4. (a) Discuss the activities associated with different stages of Project life cycle. (4)

(b) Project activity status of Judy Kramer, project manager for St. John's Hospital Project, is shown below: (16)

Activity	Description	Activity Predecessor	Time (Weeks)
A	Select Admin Staff	-------	12
B	Site selection and survey	-------	9
C	Select medical equipment	A	10
D	Prepare final construction plan	B	10
E	Bring utilities to sites	B	24
F	Interview for nursing and staff	A	10
G	Purchase and deliver equipment	C	35
H	Construct hospital	D	40
I	Develop information system	A	15
J	Install medical equipment	E, G, H	4
K	Train Nurses and staff	F, I, J	6

(i) Draw the AON network diagram

(ii) Find the project completion time

(iii) Find the critical path

(iv) Find ES/EF and LS/LF for each of the activity

(v) Find the project completion time and as well as the critical path, if the time required for activity H and J are reduced by 1 week each.

5. (a) Project A and B are offering the repayment schedules shown in the following cash flow. (12)

Year	Cash flow of Project A	Cash flow of Project B
0 (investment)	1,00,000/-	1,00,000/-
1	50,000/-	20,000/-
2	30,000/-	20,000/-
3	20,000/-	20,000/-
4	10,000/-	40,000/-
5	10,000/-	50,000/-
6		60,000/-

As shown in the table above, you have 1,00,000/- for investment and can earn a total 1,20,000/- in 5 years from Project A and 2,10,000/- in 6 years from Project B.

(i) Find the NPV, BCR and Discounted Pay Back Period for each project [Consider 10% annual interest/discount rate].

(ii) Also comment on the result with respect to investment decision.

(b) What do you mean by money inflation? Discuss its consequences in investment decision. (4)

(c) Discuss the relation between NPV and IRR of a project for different values of discount rate. (4)

6. (a) Annual Demand = 10,000 units (8)
Days per year considered in average daily demand = 365
Cost to place an order = $10
Holding cost per unit per month = 0.01% of cost per unit
Lead time = 3 days
Cost per unit = $15

(i) Determine the economic order quantity and the reorder point.
(iii) Also find the Annual Ordering and Holding cost.
(iii) State some significance of the obtained results.

(b) A computer software firm has experienced the following demands for its "Personal Finance" software package. (8)

Month 2012	Demand (Unit)
January	56
February	61
March	55
April	70
May	66

(i) Develop a regression analysis to forecast the demand and
(ii) Find the forecast for the month of January, 2013 (next year).

(c) Discuss the importance of MRP in detail. (4)

7. (a) Actual demand of a product of a certain company has been given for four quarters and forecast has been estimated by four different methods (Method1, Method2, Method3, Method4). (8)

Using MAD, find the appropriate method of forecasting among the four methods.

Quarter	Demand	Method1	Method2	Method3	Method4
1	105	100	110	120	100
2	150	120	140	140	140
3	93	125	130	125	110
4	100	110	120	120	99

(b) The following seven jobs (A to G) must pass through Machine1 and Machine2. Table below shows the operating times for both machines for each job. (10)

Job	Operations Time for Machine1	Operations Time for Machine2
A	9	5
B	8	5
C	7	7
D	6	3
E	1	2
F	2	6
G	4	7

(i) Use Johnson's rule to schedule (show job sequence and arrangement in diagram for Machine1 and 2) the seven jobs through two machines in sequence to minimize flow time.

(ii) Find the job completion time.

(iii) Find the slack time or idle time for Machine1 and 2, separately.

(c) What is safety stock? Explain. (2)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title: Professional Practices and Communication | Course Code: CE 403
Time: 2 hours | Full Marks: 100 (=12½×8)

Answer any 8 (eight) questions

1. a. Explain Green Economy? [3]
   b. How is Green Economy measured? [3]
   c. How does Green Economy contribute to sustainable development? [6½]

2. a. What is Sustainable Development? [2]
   b. What are the three pillars of Sustainable Development? [1½]
   c. Discuss any one of the three pillars of Sustainable Development [9]

3. a. Define Collective Bargaining. [2]
   b. What are the salient features of Collective Bargaining [4]
   c. Explain the roles of three parties involved in Industrial Relationship? [1½]
   d. Write down the objectives of Industrial Relationship. [5]

4. a. What are the factors on which acquiring and maintaining ethical values depend? [4½]
   b. Write down the fundamental canons of ethics. [8]

5. a. When may a person be referred as "unemployed"? [1½]
   b. Explain through equation that "steady state rate of unemployment depends on the rate of job separation and rate of job finding" using the following notations:
   L = Total labor force, E = Number of employed labor force, U =Number of unemployed labor force, s = Rate of job separation, f=Rate of job finding [8]
   c. What is price adjustment factor? Explain using the formula. [3]

6. a. What is Communication? [1½]
   b. When is a communication considered to be effective? [1]
   c. Explain the principles or "Seven C's" of effective written or oral communication. [10]

7. a. What are the different ways of delivering the oral message? Briefly explain each. [2½]
   b. Write down all elements of a typical meeting minute following the sequence as narrated in the class and explain each element. [10]

8. a. What are the different steps for preparing effective oral presentation? [2½]
   b. Write down all different parts of a business letter following correct format and sequence on the left and explain each part on the right side. [10]

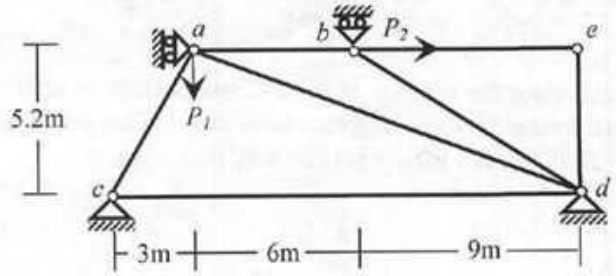
9. a. What is procurement? [1]
   b. What are different types of procurement? [1½]
   c. Write down different stages of public procurement. [5]
   d. What are the differences between OTM and LTM? [5]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Structural Engineering III | Credit Hours: 3.0 | Course Code: CE 411
Time: 3 hours | Full Marks: 90 (= 10 × 9)

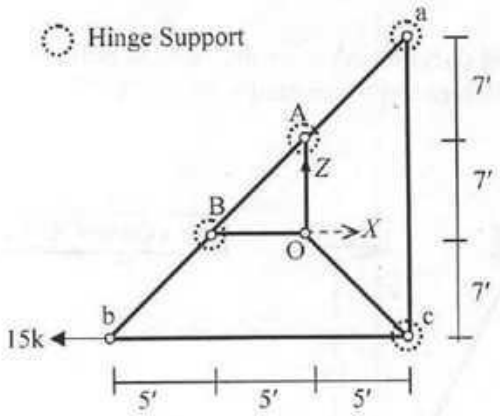
[Answer **any 09 (nine)** of the following 12 questions]

1. For the truss shown below, ignore the zero-force members and formulate the stiffness matrix, load vector and write down the boundary conditions [Given: EA/L = constant = 1000 kip/ft].

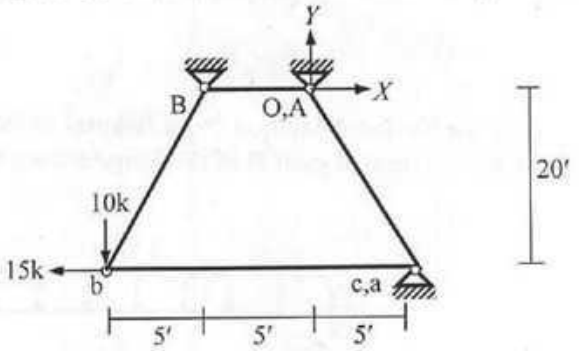


2. For the truss described in Question 1, the joint *a* deflects 0.15' downwards and *b* deflects 0.10' rightward. Calculate the (i) forces in all the members, (ii) applied loads P_1 and P_2.

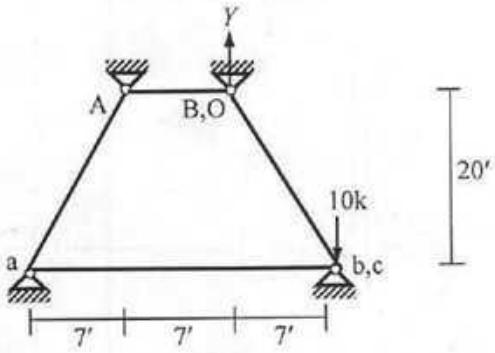
3. Ignoring zero-force members, formulate the stiffness matrix, load vector and calculate the deflections (in *X*-, *Y*- and *Z*-directions) at joint b of the space truss OABabc loaded as shown below (with nodal coordinates) [Given: S_x = constant = 500 k/ft].



Top View



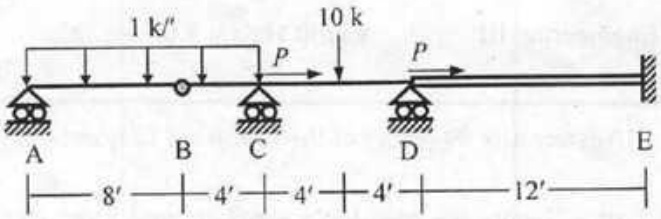
Front View



Left Side View

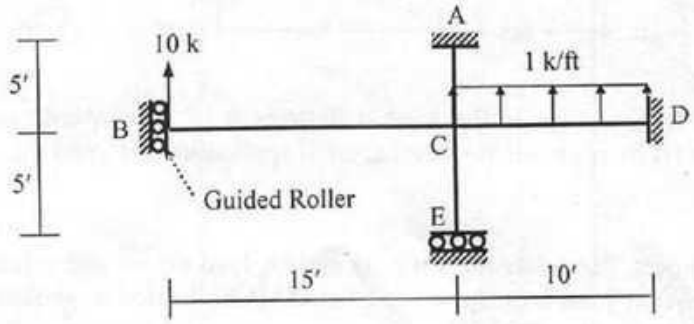
Nodal Coordinates (in ft)
O (0, 0, 0), A (0, 0, 7), B (−5, 0, 0), a (5, −20, 14), b (−10, −20, −7), c (5, −20, −7)

4. Use the Stiffness Method (considering flexural deformations only) to calculate the rotation at joints C and D of the beam $ABCDE$ shown below, if in addition to the applied loads, the support D settles $0.05'$ downwards [Given: $P = 0$, $EI = 20 \times 10^3$ k-ft^2].

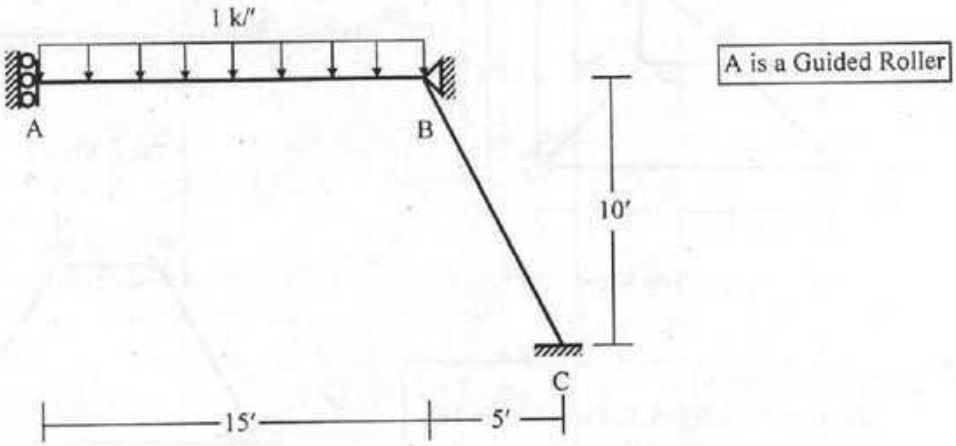


5. Use the Stiffness Method to calculate the forces P needed to cause buckling of the beam ABCDE shown in Question 4, considering flexural deformations only with geometric nonlinearity.

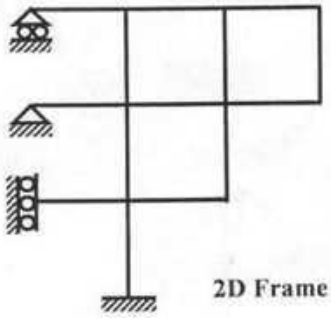
6. Use the Stiffness Method to calculate the rotation at joint C and deflection at B of the frame ABCDE loaded as shown below, considering flexural deformations only. Also calculate the joint moments [Given: $EI_{CA} = EI_{CD} = EI_{CE} = 20{,}000$ k-ft^2, $EI_{CB} = 60{,}000$ k-ft^2]



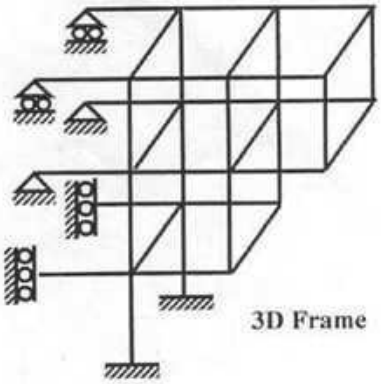
7. Use the Stiffness Method (with flexural deformations only) to calculate the vertical deflection at joint A and rotation at joint B of the frame shown below [Given: EI = constant = 40×10^3 k-ft^2].



8. Determine the size of the stiffness matrices (considering boundary conditions also) of the frames shown below. Also determine the size of the stiffness matrices if axial deformations are neglected.

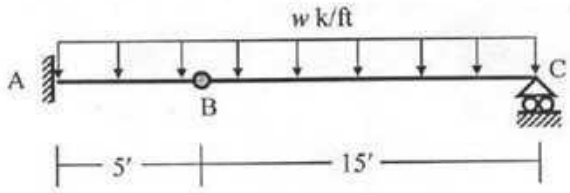


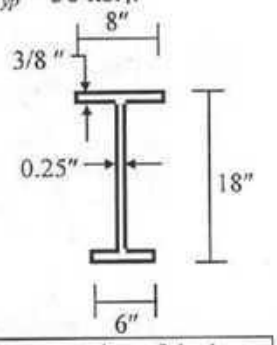
2D Frame



3D Frame

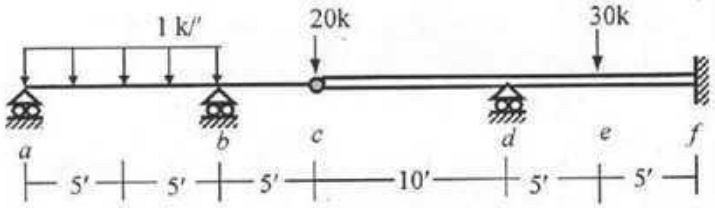
9. Calculate the distributed load w k/ft needed to develop plastic hinge mechanism of the beam ABC loaded as shown below (by using the bending moment diagram) [Given: $\sigma_{yp} = 36$ ksi].





Cross-section of the beam

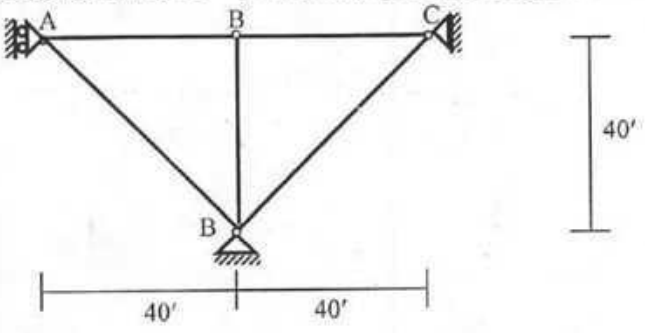
10. Use the Energy Method to calculate the plastic moment M_p necessary to prevent plastic hinge mechanism from developing in the beam *abcdef* loaded as shown in the following figure [Given: Plastic Moment $M_{p(cdef)} = 2\ M_{p\ (abc)} = M_p$].



c is an Internal Hinge

11. Use the consistent-mass matrix (considering flexural deformations only) to calculate the natural frequencies of the beam ABCDE described in Question 4, if $M_{AB} = M_{BC} = M_{CD} = 0.20$ k/ft. and $M_{DE} = 0.35$ k/ft.

12. For the truss shown in figure below, calculate the approximate natural frequencies [Given: Modulus of elasticity E = 30000 ksi, cross-sectional area A = 2 in^2, mass per unit length, m = 1.5×10^{-6} k-sec^2/in^2 for all the members].

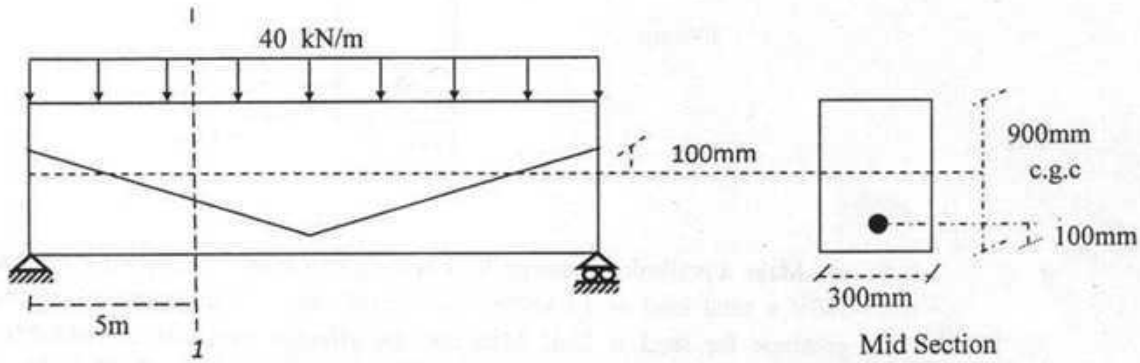


University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc Engineering (Civil)

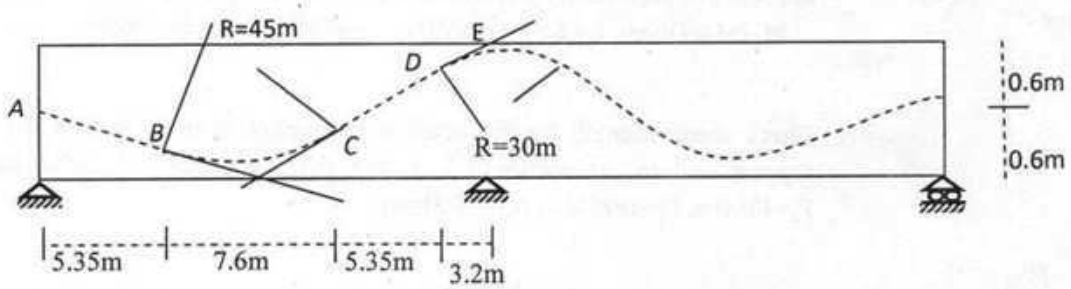
Course Title: Structural Engineering V | Course #: CE 415
Time : 2 Hr | Full Marks: 50

There are seven questions. Answer any **Five.** (5X10=50)

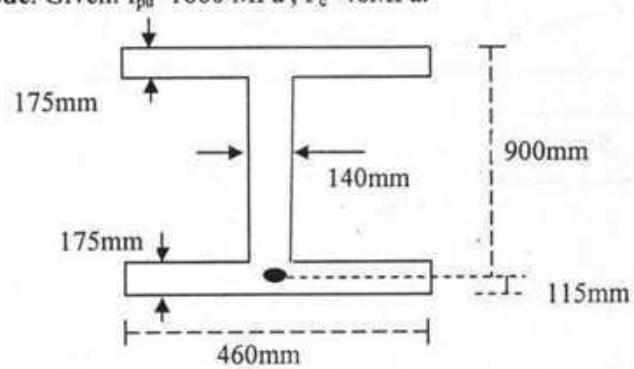
1. **a.** Draw a net sketch of the variation of steel stress with load in P.C. beam.
   b. A prestressed-concrete rectangular beam of 300 mm by 900 mm has a simple span of 15m and is loaded by a uniform load of 40 kN/m **excluding self-weight**. The effective prestress is 1620 kN. Compute the fiber stress in concrete at section 1-1 using **3rd concept**.



2. A prestressed concrete continuous beam with curved tendon is shown in figure below. Compute the percent of loss due to friction from A to E. Assume α=0.4 and K=0.0026 per meter. Use segmental approximate method.

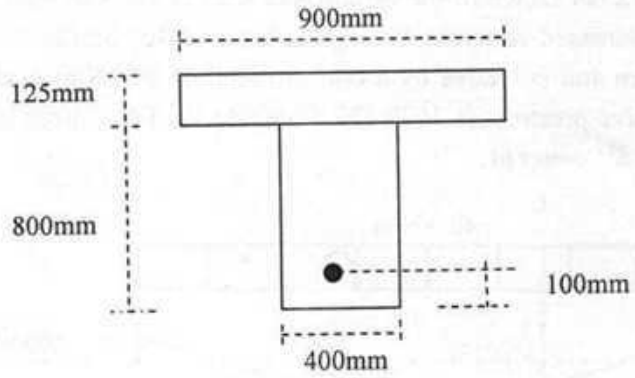


3. **a.** Write down the name of different types of loss that occur in P.C. beam.
   b. An I-shaped beam is prestressed with 2350 mm^2 steel with an effective prestress of 1100 MPa is given below. Find the ultimate moment capacity of the section for design following the **ACI code**. Given: f_{pu}=1860 MPa , f'_c=48MPa.



4. Find the ultimate moment capacity of the I-section of previous problem for design following **Strain Compatibility method**. Given: f_{pu}=1860 MPa , f'_c=48MPa, A_{ps}= 2350mm^2, f_{pe}= 1100 MPa,E_c=27000 MPa, E_p=190000 MPa .Use annexture-2.

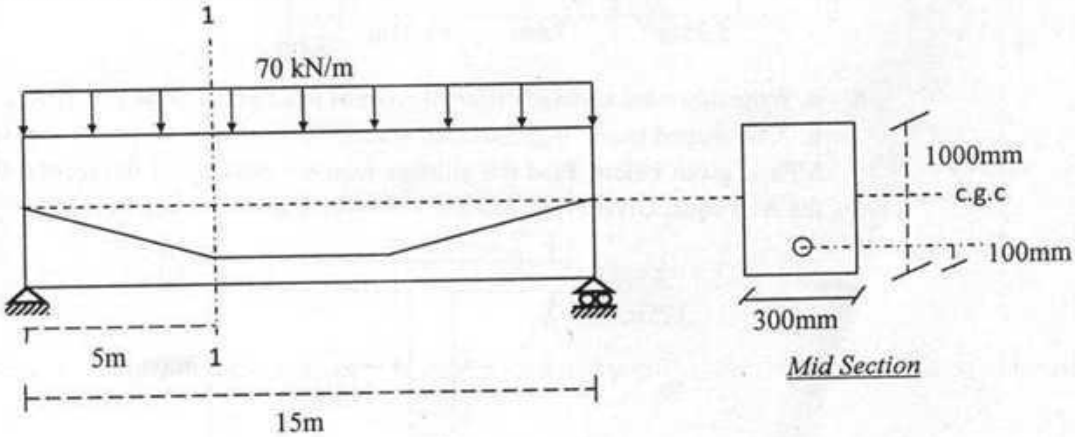
5. Mid span section of simply supported composite beam of 10m span is shown below. The precast stem (W_G=7.68 KN/m) is post-tensioned with an initial prestress force of 984 kN. The effective prestress after loss is 861 KN. The top slab (W_s=2.7 kN/m) is cast-in place above the stem. The composite section is to carry a live load moment of 450 kN-m. Compute the stresses in the section at various stages.



6. **a.** Make a preliminary design for **I-section** of a simply supported P.C. beam of 25m span to resist a total load of 40 kN/m. The overall depth of the section is 1300 mm. The Initial prestress for steel is 1302 MPa and the effective prestress is 1042 MPa. **Assume large M_G/M_T** ratio and thickness of web and flange=100mm. Given: allowable stress for concrete under working load ,f_c = -18 MPa

   b. From this preliminary **I-section** make a final design allowing **no tension and large M_G/M_T**. Given: f_c= f_b=f_t= -18MPa, f'_c= 40MPa. Minimum cover 75mm.

7. Check shear strength for the beam shown below at (a) a section h/2 distance apart from support and (b) at section 1-1 .Given that this section is adequate for w_u=70 kN/m, f'_c=40MPa. F_e=1989kN , A_{ps}=1800mm^2



Annexture-1

$$\rho = \frac{A_s}{bd}$$

$$\omega_p = \rho_p \cdot \frac{f_{pu}}{f'_c} \leq 0.3$$

$$a = \frac{A_{sp} \cdot f_{pu}}{0.85 f'_c b}$$

$$f_{ps} = f_{pu}\left(1 - \frac{1}{2}\beta_1 \cdot \frac{f_{pu}}{f'_c}\right)$$

$$M_u = \phi A_{ps} \cdot f_{ps} (d_p - a/2)$$

$$A_{pf} = \frac{0.85 f'_c (b - b_w) h_f}{f_{ps}}$$

$$M_{uf} = \phi A_{pf} \cdot f_{ps} (d_p - h_f/2)$$

$$a = \frac{A_{pw} \cdot f_{ps}}{0.85 f'_c c\, b_w}$$

$$M_{uw} = \phi A_{pw} \cdot f_{ps} (d_p - a/2)$$

$$V_{cw} = (0.29\sqrt{f'_c} + 0.3 f_{pc}) b_w d + V_p$$

$$V_{ci} = 0.05 b_w d \sqrt{f'_c} + V_d + \frac{V_i \cdot M_{cr}}{M} \geq 0.14\sqrt{f'_c} b_w d$$

$$M_{cr} = \frac{I}{y_t}(0.5\sqrt{f'_c} + f_{pe} - f_d)$$

$$\frac{M}{V} = \frac{lx - x^2}{l - 2x}$$

$$\epsilon_{pu} = \frac{f_{pe}}{E_p} + \frac{f_{pe} \cdot A_{ps}}{E_c}\left[\frac{e^2}{I_g} + \frac{1}{A_g}\right] + E_u \frac{d_p - c}{c}$$

$$\beta_1 = 0.85 - 0.00725 (f'_c - 28)$$

$$C = 0.85 \beta_1 f'_c b a c$$

$$= 0.85 f'_c b h_f + 0.85 f'_c b_w (\beta_1 c - h_f)$$

$$T = f_{pu} \cdot A_{sp}$$

$$F_e = \frac{M_T}{0.65 h}$$

$$A_{ps} = F_e / f_{pe}$$

$$A_c = \frac{A_{ps} \cdot f_{pe}}{0.5 f_c}$$

$$k_t = b^2/c_b \; ; \; k_b = \frac{y^2}{c_t}$$

$$e - k_b = M_G / F_o$$

$$F_e = M_T / e + k_t$$

$$A_c = F_e h / f_t \cdot c_b$$

$$A_c = \frac{F_o}{f_b}\left(1 + \frac{e - (M_G/F_o)}{k_t}\right)$$

$$A_c = F_o h / f_b c_t$$

Annexture-2

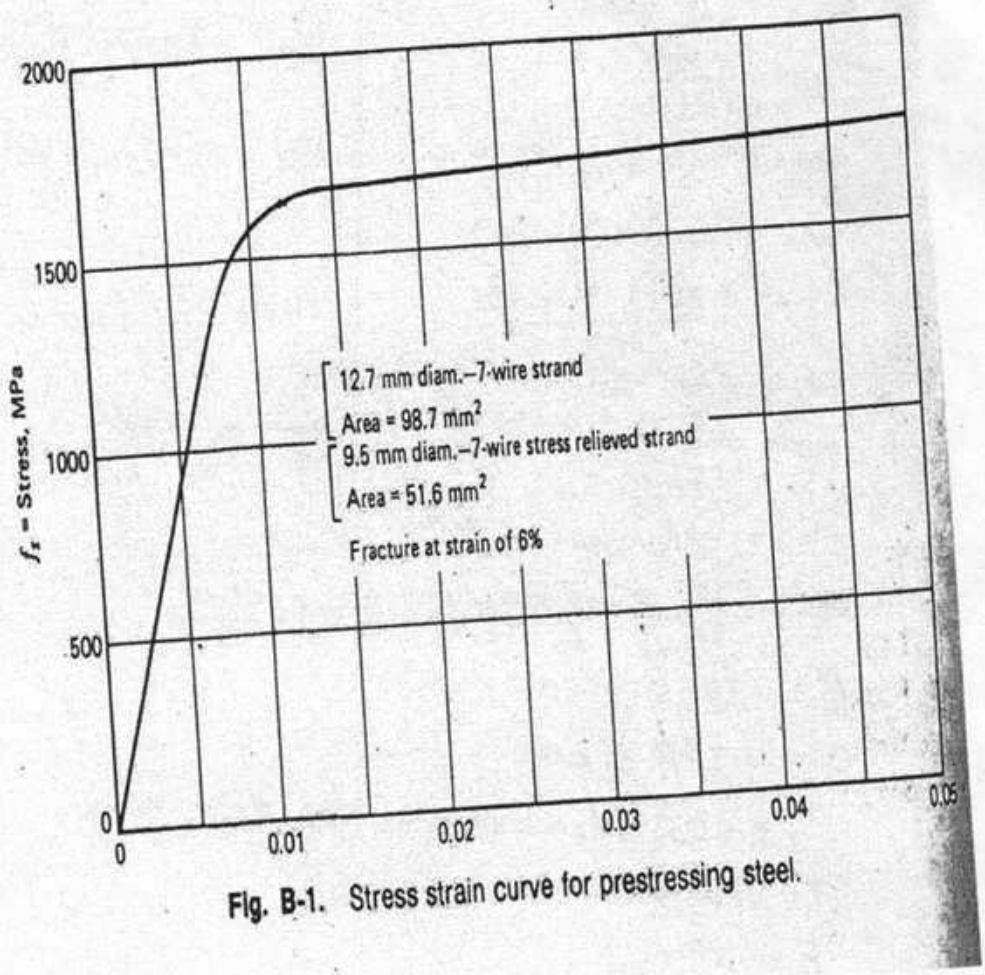


Fig. B-1. Stress strain curve for prestressing steel.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc Engineering (Civil)

Course Title: Structural Engineering VI (Design of Steel Structures) Course Code: CE 417
Time: 2 hours Full Marks: 50

The figures in the margin indicate full marks.
Assume reasonable values for any missing data. Annexures are provided to facilitate design.
There are EIGHT questions. Answer any SIX questions

1. Calculate the probable net areas for the tension splice shown in Fig.1 and hence find the net area that governs the splice design. All material is A36 steel. Bolts are 5/8-in. A325 in standard holes. Also determine the effective net area if U=0.85. 8 ⅓

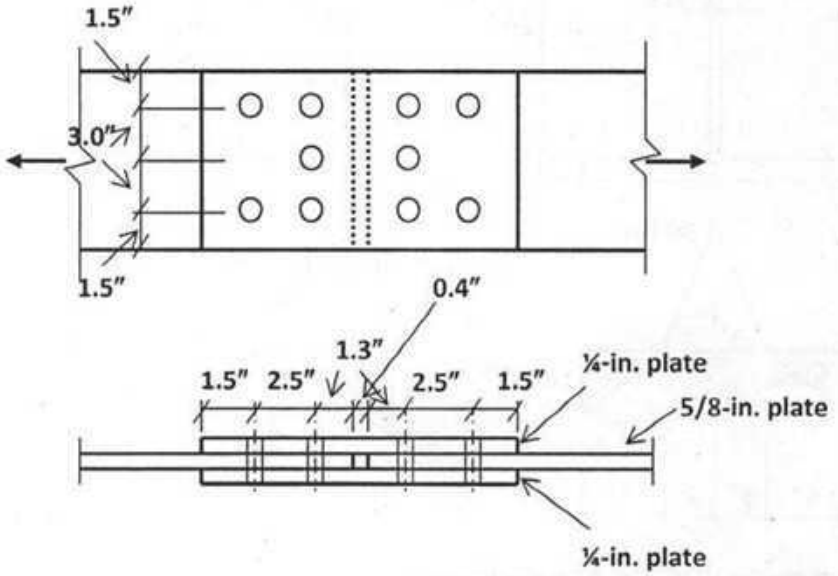


Fig. 1

2. The residual stress for a 20x2-in. plate to be used as a tension member is shown in Fig. 2. Write the equation for the stress-strain behaviour in tension of the plate at an imposed tensile strain of 0.0008. What is the average stress in the section at a strain of 0.0014? Given: F_y=42 ksi; E=30000 ksi. 8 ⅓

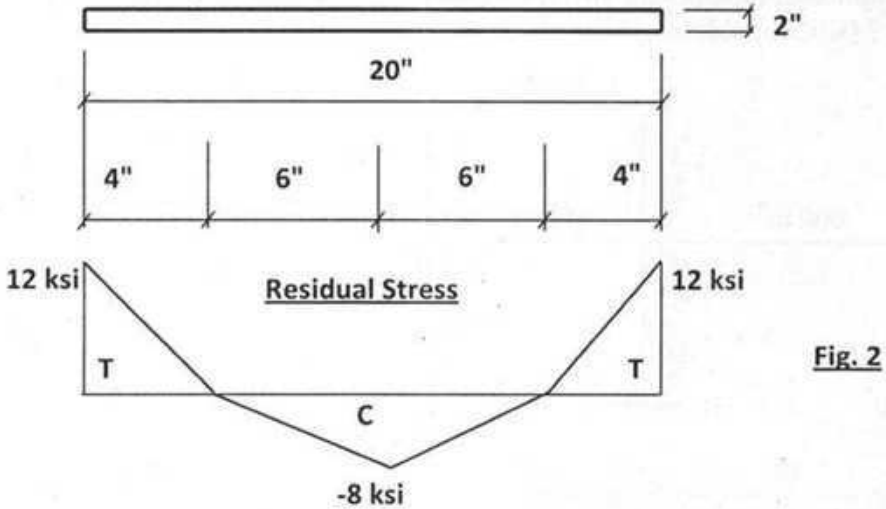
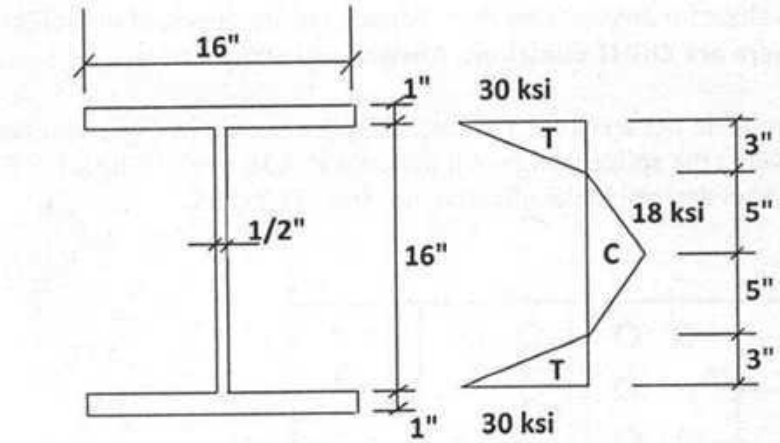
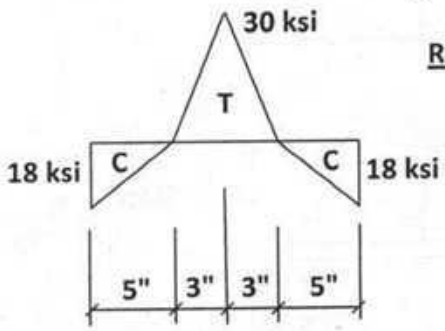


Fig. 2

3. The equation for the stress-strain curve for the cross section with the residual stresses shown in Fig. 3 was determined as $\sigma = -15{,}625{,}000\varepsilon^2 + 48{,}750\varepsilon - 5.625$ for a range of compressive strain $-0.0006 \leq \varepsilon \leq -0.0012$. Determine the values of stress and tangent modulus, if a column with the given section is subjected to an imposed uniform compressive strain of 0.0010 in./in. What is the corresponding slenderness ratio L/r according to tangent modulus E_t, if the column buckles at this compressive strain. Compressive strain 0.0010 is to be taken as positive in the above stress-strain equation. 8 ⅓



Residual Stress in Web



Residual Stress in Top & Bottom Flanges

Fig. 3

4. Determine the effective length coefficients for the columns BC, EF, CD and FG of the frame shown in Fig. 4. The relevant moments of inertia of the members in inch^4 are shown in the figure. The Nomographs are provided in Annexure-1. Given: The multiplication factors for stiffnesses for a beam with far end fixed are 2/3 (with sidesway) and 2 (without sidesway). 8 ⅓

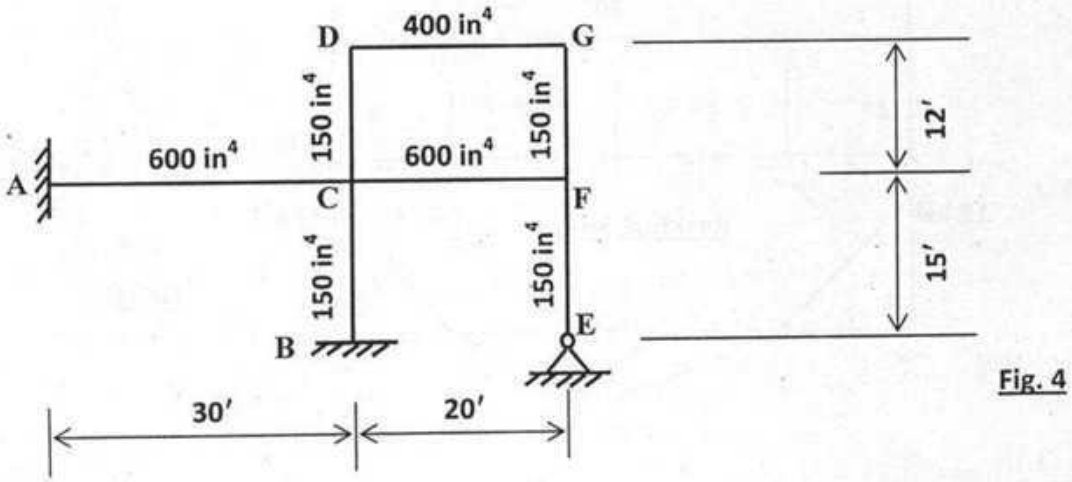


Fig. 4

5. Compute the yield moment and plastic moment capacities and shape factor for major axis bending of the section shown in Fig. 5. Given: $F_y = 42$ ksi. 8 ⅓

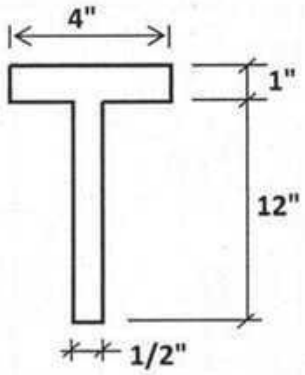


Fig. 5

6. A W12x58 section as shown in Fig.6 is used for a 22 ft. long column. The section has an area of 17 in^2 and a radius of gyration, $r_x = 5.28$ in. and $r_y = 2.51$ in. about the strong axis X and the weak axis Y respectively. If effective length factor for buckling about major axis X is $K_x = 1$ and that for buckling about minor axis Y is $K_y = 0.7$, calculate the allowable load P for the column using AISC/ASD method. Given: $F_y = 36$ ksi and E = 29000 ksi. See Annexure-2. 8 ⅓

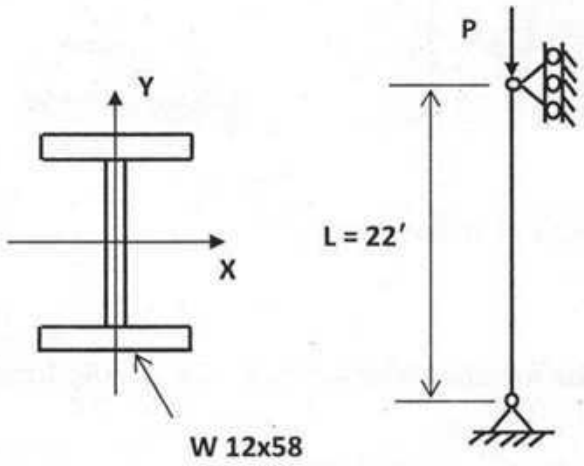
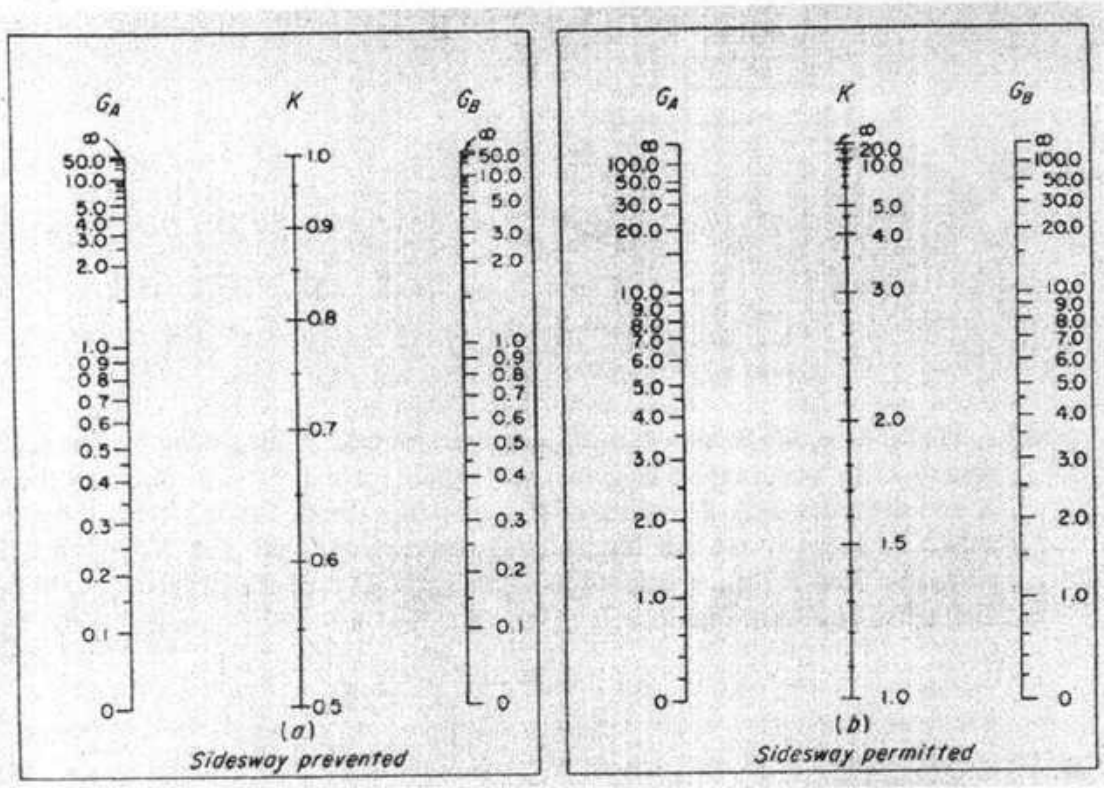


Fig. 6

7. Using LRFD method, calculate the design strength of a W10x45 section for a 22 ft. long column. The section has an area of 13.3 in^2 and a radius of gyration, $r_x = 4.32$ in. and $r_y = 2.01$ in. about the strong axis X and the weak axis Y respectively. Given: Effective length factor for buckling about major axis X is $K_x = 2$ and that for buckling about minor axis Y is $K_y = 1$; $F_y = 36$ ksi and E = 29000 ksi. See Annexure-3. 8 ⅓

8. Assuming that the beam will be braced to satisfy compact-section requirements, select the lightest W section to carry a uniformly distributed live load of 1.5 kips/ft and a dead load (not including the weight of the beam) of 0.50 kips/ft on a 30-ft simply supported span. What will be the least spacing of lateral bracings to satisfy the compact section requirements? Also check whether the deflection criterion is satisfied or not. Given: $F_y = 36$ ksi. See Annexures-4 & 5. 8 ⅓

ANNEXURE-1



Nomograph for effective length of columns.

ANNEXURE-2

The AISC/ASD formulas for allowable stress F_a on axially loaded compression members are

$$F_a = \begin{cases} \dfrac{F_y\left[1 - \dfrac{1}{2}\left(\dfrac{KL/r}{C_c}\right)^2\right]}{\dfrac{5}{3} + \dfrac{3}{8}\dfrac{KL/r}{C_c} - \dfrac{1}{8}\left(\dfrac{KL/r}{C_c}\right)^3} & \dfrac{KL}{r} \le C_c \qquad (4\text{-}17) \\ \dfrac{12\pi^2 E}{23(KL/r)^2} = \dfrac{149{,}000}{(KL/r)^2} & \dfrac{KL}{r} \ge C_c \qquad (4\text{-}18) \end{cases}$$

where K is the effective-length coefficient (Art. 4-5) and

$$C_c = \pi\sqrt{\frac{2E}{F_y}}$$

ANNEXURE-3

The AISC/LRFD design strength of columns is $\phi_c P_n$, where $\phi_c = 0.85$ and $P_n = A_g F_{cr}$, with F_{cr} given by

$$F_{cr} = \begin{cases} 0.658^{\lambda_c^2} F_y & 0 \le \lambda_c < 1.5 \quad (4\text{-}27) \\ \dfrac{0.877}{\lambda_c^2} F_y & \lambda_c > 1.5 \quad (4\text{-}28) \end{cases}$$

in which

$$\lambda_c = \frac{KL}{r\pi}\sqrt{\frac{F_y}{E}}$$

ANNEXURE-4

Specification Formulas

AISC/ASD. The allowable bending stress F_b for channels and I-shaped members of steels with $F_y \le 65$ ksi, supported against lateral buckling and bent about the major axis, are as follows:

Compact section: $F_b = 0.66F_y$ (5-16a)

Noncompact section: $F_b = 0.60F_y$ (5-16b)

If $65/\sqrt{F_y} \le b_f/2t_f \le 95/\sqrt{F_y}$:

$$F_b = \begin{cases} F_y\left(0.79 - 0.002\dfrac{b_f}{2t_f}\sqrt{F_y}\right) & \text{(rolled shapes)} \quad 5\text{-}16c \\ F_y\left(0.79 - 0.002\dfrac{b_f}{2t_f}\sqrt{\dfrac{F_y}{k_c}}\right) & \text{(built-up members)} \quad (5\text{-}16d) \end{cases}$$

where $$k_c = \begin{cases} 1 & \text{if } \dfrac{h}{t} \le 70 \\ \dfrac{4.05}{(h/t)^{0.46}} & \text{if } \dfrac{h}{t} > 70 \end{cases}$$

Notation in Eqs. (5-16) is as follows:

b_f = flange width
t_f = flange thickness
h = distance between adjacent lines of fasteners, or clear distance between flanges if welds are used
t = web thickness

ANNEXURE-4 (Contd.)

Lateral support may be continuous, as for a beam which is the direct support of a floor, or by bracing members. Lateral-support spacing for beams designed for $F_b = 0.66F_y$ must not exceed the smaller of the values of L_c given by the following:

$$L_c = \frac{76b_f}{\sqrt{F_y}} \qquad (5\text{-}17a)$$

$$L_c = \frac{20{,}000}{F_y d/A_f} \qquad (5\text{-}17b)$$

DESIGN FOR LIMITED DEFLECTION

$$\frac{L}{d} = \frac{480}{F_b} \qquad (5\text{-}13)$$

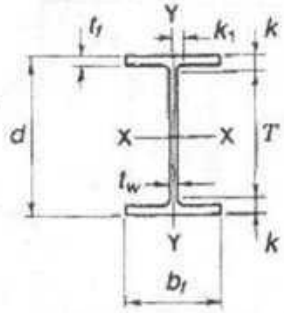
ANNEXURE-5

ALLOWABLE STRESS DESIGN SELECTION TABLE
For shapes used as beams

S_x

F_y = 50 ksi			S_x	Shape	Depth d	F'_y	F_y = 36 ksi		
L_c	L_u	M_R					L_c	L_u	M_R
Ft	Ft	Kip-ft	In.^{3}		In.	Ksi	Ft	Ft	Kip-ft
8.1	8.5	464	**176**	**W 24× 76**	**23⅞**	—	**9.5**	**11.8**	**348**
9.3	20.2	481	175	W 16×100	17	—	11.0	28.1	347
13.1	29.2	476	173	W 14×109	14⅜	58.6	15.4	40.6	343
7.5	10.9	470	171	W 21× 83	21⅜	—	8.8	15.1	339
9.9	15.5	457	166	W 18× 86	18⅜	—	11.7	21.5	329
13.0	26.7	432	157	W 14× 99	14⅛	48.5	15.4	37.0	311
9.3	18.0	426	155	W 16× 89	16¾	—	10.9	25.0	307
7.4	8.5	424	**154**	**W 24× 68**	**23¾**	—	**9.5**	**10.2**	**305**
7.4	9.6	415	151	W 21× 73	21¼	—	8.8	13.4	299
9.9	13.7	402	146	W 18× 76	18¼	64.2	11.6	19.1	289
13.0	24.5	393	143	W 14× 90	14	40.4	15.3	34.0	283
7.4	8.9	385	**140**	**W 21× 68**	**21⅛**	—	**8.7**	**12.4**	**277**
9.2	16.8	369	134	W 16× 77	16½	—	10.9	21.9	265
5.8	6.4	350	**131**	**W 24× 62**	**23¾**	—	**7.4**	**8.1**	**259**
7.4	8.1	349	**127**	**W 21× 62**	**21**	—	**8.7**	**11.2**	**251**
6.8	11.1	349	127	W 18× 71	18½	—	8.1	15.5	251
8.1	20.2	338	123	W 14× 82	14¼	—	10.7	28.1	244
10.9	26.0	325	118	W 12× 87	12½	—	12.8	36.2	234
6.8	10.4	322	117	W 18× 65	18⅜	—	8.0	14.4	232
9.2	13.9	322	117	W 16× 67	16⅜	—	10.8	19.3	232

ANNEXURE-5 (Contd.)

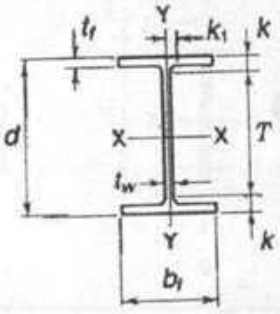


W SHAPES
Dimensions

Desig-nation	Area A	Depth d		Web			Flange				Distance		
				Thickness t_w		$\frac{t_w}{2}$	Width b_f		Thickness t_f		T	k	k_1
	In.^{2}	In.		In.		In.	In.		In.		In.	In.	In.
W 21×402*	118.0	26.02	26	1.730	1¾	⅞	13.405	13⅜	2.30	2⅜	18¼	3⅜	1⅞
×364*	107.0	25.47	25½	1.590	1⅝	¾	13.265	13¼	2.150	2⅛	18¼	3⅛	1¾
×333*	97.9	25.00	25	1.460	1½	¾	13.130	13⅛	2.020	2	18¼	3	1⅝
×300*	88.2	24.53	24½	1.320	1⅜	¾	12.990	13	1.880	1⅞	18¼	2⅞	1½
×275*	80.8	24.13	24⅛	1.220	1¼	⅝	12.890	12⅞	1.780	1¾	18¼	2¾	1⅜
×248*	72.8	23.74*	23¾	1.100	1⅛	⅝	12.765	12¾	1.660	1⅝	18¼	2⅝	1⅜
×223	65.4	23.35	23⅜	1.000	1	½	12.675	12⅝	1.570	1½	18¼	2½	1⅜
×201	59.2	23.03	23	0.910	⅞	½	12.575	12½	1.470	1½	18¼	2⅜	1⅜
×182	53.6	22.72	22¾	0.830	⅞	½	12.500	12½	1.390	1⅜	18¼	2⅜	1⅜
×166	48.8	22.48	22½	0.750	¾	⅜	12.420	12⅜	1.360	1⅜	18¼	2⅛	1⁹⁄₁₆
×147	43.2	22.06	22	0.720	¾	⅜	12.510	12½	1.150	1⅛	18¼	1⅞	1⅛
×132	38.8	21.83	21⅞	0.650	⅝	⁵⁄₁₆	12.440	12½	1.035	1⅛	18¼	1¹³⁄₁₆	1
×122	35.9	21.68	21⅝	0.600	⅝	⁵⁄₁₆	12.390	12⅜	0.960	¹⅞	18¼	1¹¹⁄₁₆	1
×111	32.7	21.51	21½	0.550	⁹⁄₁₆	⁵⁄₁₆	12.340	12⅜	0.875	⅞	18¼	1⅝	¹⁵⁄₁₆
×101	29.8	21.36	21⅜	0.500	½	¼	12.290	12¼	0.800	¹³⁄₁₆	18¼	1⁹⁄₁₆	¹⁵⁄₁₆
W 21× 93	27.3	21.62	21⅝	0.580	⁹⁄₁₆	⁵⁄₁₆	8.420	8⅜	0.930	¹⅞	18¼	1¹¹⁄₁₆	1
× 83	24.3	21.43	21⅜	0.515	½	¼	8.355	8⅜	0.835	¹³⁄₁₆	18¼	1⁹⁄₁₆	¹⁵⁄₁₆
× 73	21.5	21.24	21¼	0.455	⁷⁄₁₆	¼	8.295	8¼	0.740	¾	18¼	1½	¹⁵⁄₁₆
× 68	20.0	21.13	21⅛	0.430	⁷⁄₁₆	¼	8.270	8¼	0.685	¹¹⁄₁₆	18¼	1⁷⁄₁₆	⅞
× 62	18.3	20.99	21	0.400	⅜	⁹⁄₁₆	8.240	8¼	0.615	⅝	18¼	1⅜	⅞

ANNEXURE-5 (Contd.)

W SHAPES
Properties



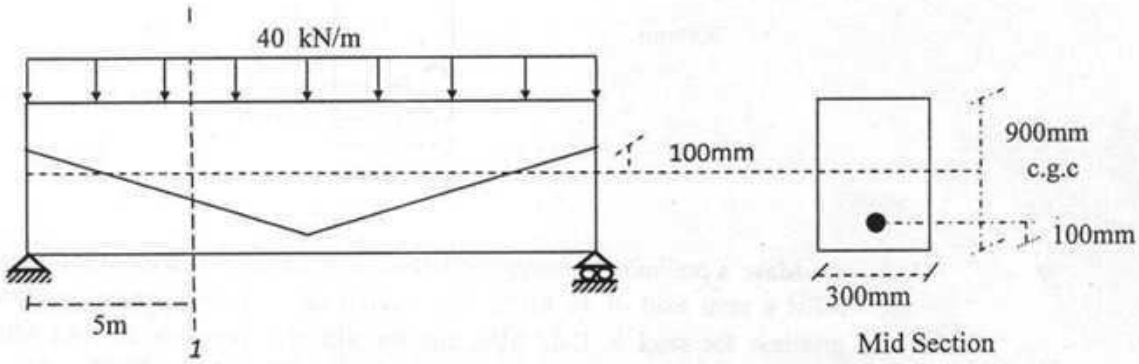
Nominal Wt. per Ft	Compact Section Criteria $\frac{b_f}{2t_f}$	Compact Section Criteria F_y'	Compact Section Criteria $\frac{d}{t_w}$	Compact Section Criteria F_y''	r_T	$\frac{d}{A_f}$	Elastic Properties Axis X-X I	Axis X-X S	Axis X-X r	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Plastic Modulus Z_x	Plastic Modulus Z_y	Designation
Lb.		Ksi		Ksi	In.		In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.	In.^{3}	In.^{3}	
402	2.1	—	15.0	—	3.63	0.62	12200	937	10.2	3270	383	3.02	1080	586	W 21×402
364	2.3	—	16.0	—	3.59	0.69	10800	846	10.0	2960	348	3.00	970	530	×364
333	2.5	—	17.1	—	3.55	0.76	9610	767	9.91	2690	317	2.98	880	482	×330
300	2.7	—	18.6	—	3.51	0.78	8490	692	9.81	2420	285	2.96	794	435	×300
275	2.9	—	19.8	—	3.48	0.85	7620	632	9.74	2190	260	2.94	724	398	×275
248	3.2	—	21.9	—	3.45	0.90	6760	569	9.68	1940	234	2.93	652	359	×248
223	3.5	—	23.4	—	3.41	1.02	6050	518	9.59	1750	214	2.91	593	329	×223
201	3.8	—	25.3	—	3.38	1.12	5310	461	9.47	1550	192	2.89	530	295	×201
182	4.2	—	27.4	—	3.36	1.23	4730	417	9.40	1420	176	2.87	479	270	×182
166	4.6	—	30.0	—	3.34	1.33	4280	380	9.36	435	70.1	2.98	432	108	×166
147	5.4	—	30.6	—	3.34	1.53	3630	329	9.17	376	60.1	2.95	373	92.6	×147
132	6.0	—	33.6	58.6	3.31	1.70	3220	295	9.12	333	53.5	2.93	333	82.3	×132
122	6.5	—	36.1	50.6	3.30	1.82	2960	273	9.09	305	49.2	2.92	307	75.6	×122
111	7.1	—	39.1	43.2	3.28	1.99	2670	249	9.05	274	44.5	2.90	279	68.2	×111
101	7.7	—	42.7	36.2	3.27	2.17	2420	227	9.02	248	40.3	2.89	253	61.7	×101
93	4.5	—	37.3	47.5	2.17	2.76	2070	192	8.70	92.9	22.1	1.84	221	34.7	W 21× 93
83	5.0	—	41.6	38.1	2.15	3.07	1830	171	8.67	81.4	19.5	1.83	196	30.5	× 83
73	5.6	—	46.7	30.3	2.13	3.46	1600	151	8.64	70.6	17.0	1.81	172	26.6	× 73
68	6.0	—	49.1	27.4	2.12	3.73	1480	140	8.60	64.7	15.7	1.80	160	24.4	× 68
62	6.7	—	52.5	24.0	2.10	4.14	1330	127	8.54	57.5	13.9	1.77	144	21.7	× 62

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc Engineering (Civil)

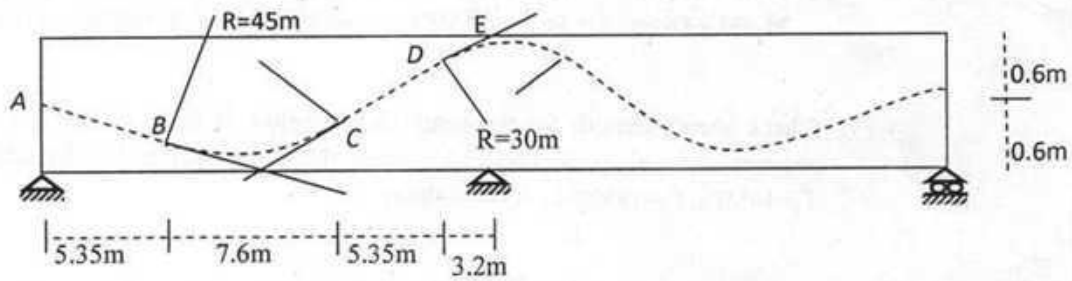
Course Title: Structural Engineering V | Course #: CE 415
Time : 2 Hr | Full Marks: 50

There are seven questions. Answer any **Five**. (5X10=50)

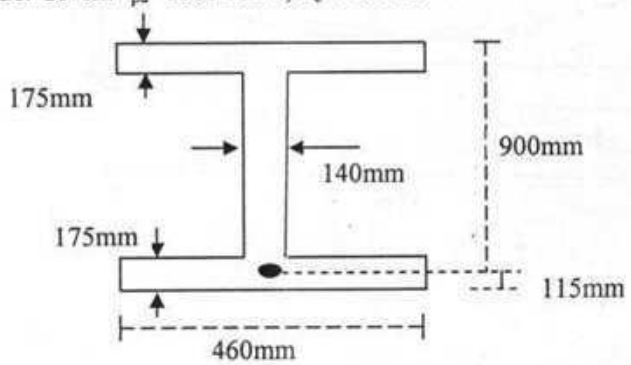
1. **a.** Draw a net sketch of the variation of steel stress with load in P.C. beam.
   b. A prestressed-concrete rectangular beam of 300 mm by 900 mm has a simple span of 15m and is loaded by a uniform load of 40 kN/m **excluding self-weight**. The effective prestress is 1620 kN. Compute the fiber stress in concrete at section 1-1 using **3rd concept**.



2. A prestressed concrete continuous beam with curved tendon is shown in figure below. Compute the percent of loss due to friction from A to E. Assume α=0.4 and K=0.0026 per meter. Use segmental approximate method.



3. **a.** Write down the name of different types of loss that occur in P.C. beam.
   b. An I-shaped beam is prestressed with 2350 mm^2 steel with an effective prestress of 1100 MPa is given below. Find the ultimate moment capacity of the section for design following the **ACI code**. Given: f_{pu}=1860 MPa , f'_c=48MPa.



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering III — Course Code: CE 431
Time: 2 hour — Full marks: 100

Answer any FOUR out of FIVE.
(Note: Assume any missing data)

1. (a) Briefly explain the stages of decomposition in a typical landfill. (7)

   (b) Write explanatory notes on the following: (9)
   i) Incineration ii) Significance of Source Reduction iii) Street cleansing

   (c) Estimating the methane potential of discards. (9)
   Suppose "as delivered" MSW discards include 67.3 percent decomposable materials such as paper, yard trimmings, food waste and wood. Of that 32.3 percent is moisture. An elemental analysis of the dried decomposable components yields the following mass percentages:

Element	C	H	O	N	Other	Total
Dry mass (%)	44.17	5.91	42.50	0.73	6.69	100%

   Find the chemical formula for the C, H, O, N portion of the decomposables.Also find the energy content of the methane that would be generated per kg of discards. The HHV (high heating value) of methane is 890 kj/mol.

2. (a) Describe briefly the risks associated with poor management of solid waste. (7)

   (b) Explain the collection methods on the basis of mode of operation. (5)

   (c) Define the after-use of landfill sites. How do the migration of landfill gas can be controlled ? (7)

   (d) Estimate the landfill area needed to handle one year's MSW for a town of 100,000 people. Assume per capita national average discards of 3 lbs per day, no combustion, a landfill density of 1,000 lb/yd^3 and one 10-foot lift per year. Assume 20 % of the cell volume is soil used for cover. (6)

3. (a) Do you suggest ocean can be a place for dumping hazardous waste ? Justify your answer. (5)

   (b) Explain the following terms. (any four) (14)
   i)Health care waste management ii) Biogas aspect in Bangladesh iii) Material Recovery Facilities(MRF) iv)Waste-to-energy v) Hazardous waste landfill

(c) A recent study on recycling at the Los Angeles International Airport(LAX) generates about 19,000 tons of solid waste per year (1.3 pounds per passenger). On the annual basis , LAX recycles 12 tons of aluminum; 2,021 tons of cardboard ; 527 tons of office paper, 89 tons of newspaper, 17 tons of glass and 921 tons of plastic. In addition, they compost 271 tons of food waste. (6)

i. Find the equivalent greenhouse gas savings associated with these recycled and composted materials assuming they would have all gone to a landfill if they hadn't been recycled.

ii. If the landfill charges \$80/ton (called the tipping fee), how much money is saved in tipping fees by recycling and composting ?

iii. If, in the future, there is a carbon tax \$10 per metric ton of carbon dioxide, how much would LAX save in carbon taxes at the current recycling rate ?

(a) Explain the human exposure pathways for hazardous wastes. (7)

(b) Is there any landfill site in Bangladesh ? If yes ; where and what type of landfill system is adopted ? Which countries assist the Bangladesh Govt. technically ? (3)

(c) Define "EPA "or sometimes "USEPA". Why regulations for New landfill is so important ? (6)

(d) Write down the objectives of thermal treatment processes. (3)

(e) The United States discards roughly 167 million tons of MSW. The High Heating Value of those discards is about 6,000 Btu/lb. A mass-burn waste-to-energy facility can convert those wastes to electricity with a heat rate of 17,000 Btu of thermal input per KWh of electrical output (roughly 20% efficiency). Estimate the electrical energy that could be produced per year if all our discards were used in this type of WTE system. Compare it with the total that is now generated which is about 4,000X 10^9 KWh/yr. (6)

(a) Explain transfer station including its advantages and disadvantages. (10)

(b) Write down the problems associated in hazardous wastes treatment and disposal system in developing countries. (5)

(c) A transfer station handling 300 tons/day, 5 days per week, costs \$5 million to build and \$150,000 per year to operate. An individual tractor-trailer costs \$140,000 and carries 15 tons per trip. Operations costs and maintenance costs (including fuel) of the trucks are \$50,000/yr; the drivers make \$40,000/yr (including benefits). The capital costs of the building and transfer trucks are to be amortized over a 10-year period using a 12 percent discount factor. (10)

Suppose it takes 30 minutes to make a one-way trip from the transfer station to the disposal site and 7 round trips per day are made. Find the transfer station and hauling cost in dollars per ton.

Note: The necessary chart is given below:

TABLE 9.8

Net Greenhouse Gas Emission Reductions Compared to Landfilling for Source Reduction, Recycling, Composting, or Combustion in Metric Tons of Carbon Equivalents Per Ton of Material (MTCE/ton)

Materials	Source Reduction		Recycling or Composting versus Landfilling	Combustion versus Landfilling
	Current Mix of Inputs	100% Virgin Inputs		
Aluminum cans	2.28	4.28	3.71	−0.01
Corrugated cardboard	1.63	2.32	0.96	0.29
Fly ash	0.01	0.01	0.25	0.01
Food waste composted	NA	NA	0.25	0.25
Glass	0.88	1.02	0.50	0.43
HDPE	0.50	0.55	0.39	−0.24
Magazines	2.28	2.36	0.76	0.05
Mixed metals	NA	NA	1.44	0.30
Mixed MSW	NA	NA	NA	0.15
Mixed paper	NA	NA	1.06	0.27
Mixed plastics	NA	NA	0.42	−0.26
Mixed recyclables	NA	NA	0.83	0.20
Newspapers	1.09	1.39	0.52	−0.03
Office paper	2.71	2.79	1.31	0.70
Personal computers	15.14	15.14	0.63	0.06
PET	0.58	0.60	0.43	−0.28
Steel cans	0.88	1.02	0.50	0.43
Textbooks	3.03	3.11	1.38	0.70
Tires	1.10	1.10	0.51	−0.04
Yard trimmings	NA	NA	−0.01	0.00

Source: U.S. EPA. 2006b.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering VII — Course Code: CE 439
Time: 2 hour — Full marks: 100

Question No. 1 is compulsory. Answer THREE from the rest.
(Note: Assume any missing data)

1. (a) The following potential negative impacts will be occurred, due to implementation of a flood protection embankment : (25)

   loss of land ; loss of income; loss of trees; damage of crop fields; dust blowing; noise level rise; loss of top soil from agricultural land; water logging ; fisheries; wild life.

   Prepare an environmental Mitigation plan and Monitoring plan.

2. (a) Describe the main steps include in the EIA process. (15)

   (b) Briefly discuss the environmental clearance procedure from DoE (Department of Environment) for all category industrial units and projects. (10)

3. (a) Write down the types of impacts of different projects ? Discuss them briefly. (15)

   (b) Categories the following project into green, orange-A, orange-B and red category projects. (10)

   I. Animal slaughter house- a) Slaughter of cows/ buffaloes (number greater than 10 but less than or equal to 20 per day)
   II. Hospital (number of beds more than 20 but less than or equal to 50 beds)
   III. Hospital (number of beds more than 50)
   IV. Fishing and aquaculture on land measuring between 2 to 10 hectres
   V. Fishing and aquaculture –a) aquaculture development projects of an area more than 10 ha.
   VI. Waste management-a) Sewage treatment plant (STP), excluding industrial STP , b) Common Effluent Treatment Plant (CETP)
   VII. Industries involved with manufacture, storage or use of radioactive materials
   VIII. Nuclear power plant
   IX. Poultry (up to 250 in urban areas and up to 1,000 in rural areas)
   X. Sewing thread coning, without dyeing and washing

4. (a) Define baseline environment (physical, biological, socio-economic) of a project area. (8)

   (b) Why Environmental Management Plan is vital in EIA ? Discuss environmental mitigation plan and environmental monitoring plan. (5+12)

5. (a) Discuss the importance of EIA (Environmental Impact Assessment) for a construction related project. (8)

(b) Write down the obstacles to the implementation in EIA. (5)

(c) What are the policies, acts & rule related to the environment protection in Bangladesh ? (12)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring – 2012
Program: B. Sc. Engineering (Civil)

Course Title: Geotechnical Engineering II | Course Code: CE 441
Time: 3 hours | Full Marks: 120 (20 X 6 = 120)

Answer any 6 (six) of the following 8 (eight) questions

1. (a) What is subsurface exploration in terms of geotechnical engineering? Give two reasons as to why subsurface exploration is required in geotechnical engineering. 4

   (b) Write down the preliminary information that would be important to execute geotechnical subsurface exploration for a building and for a bridge project. 4

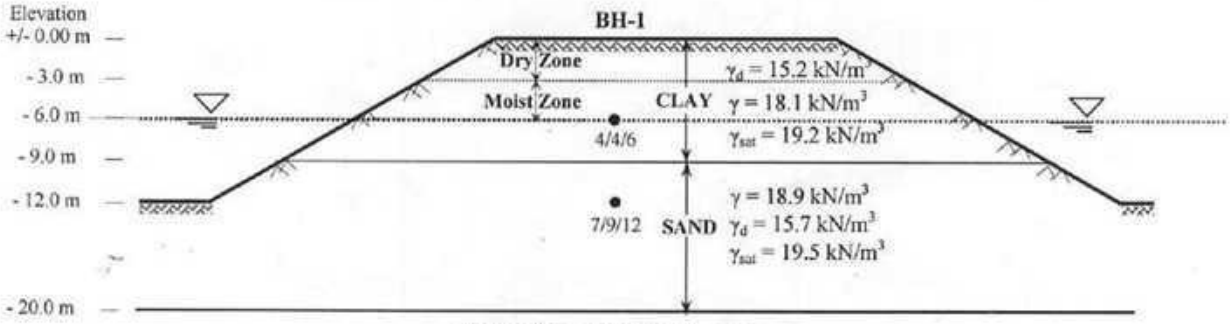
   (c) Write down any two general guidelines used for the selection of depth and location of boreholes for typical civil engineering projects. 4

   (d) Write short notes on (any two): 4 x 2=8

   (i) Standard Penetration Test (ii) Drilling & logging (iii) Disturbed and undisturbed sampling

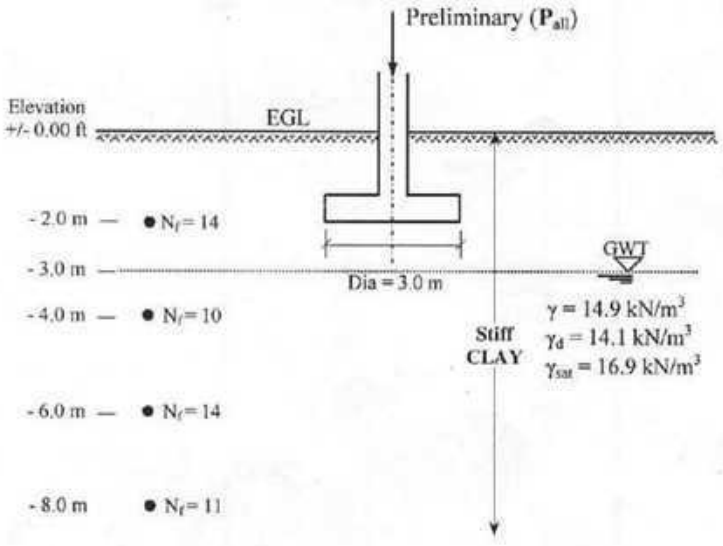
2. (a) Is it possible to collect absolutely undisturbed sample? Write a short note on the expression to quantify degree of disturbances during sampling procedure. 4

   (b) A borehole was advanced as a part of a preliminary geotechnical investigation for a site in Bangladesh as shown below. Determine cohesion and angle of internal friction at corresponding depths of the clay and sand deposits, respectively, based on the available data (Use empirical correlations as provided in **Appendix**). Use hammer efficiency as 58%. 9

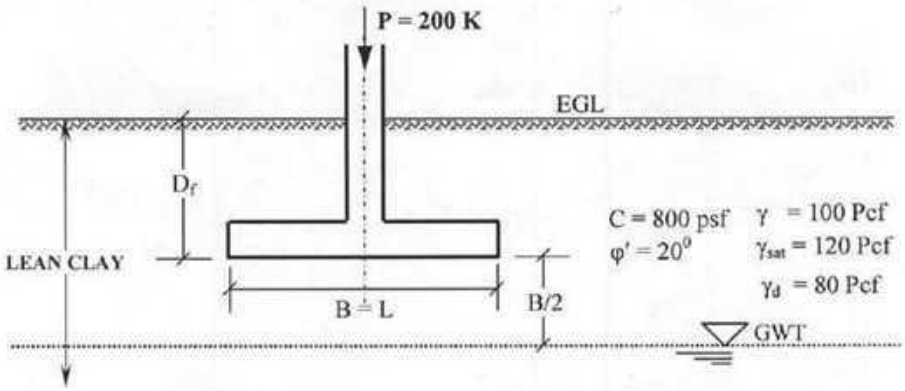


Subsurface Soil Stratigraphy

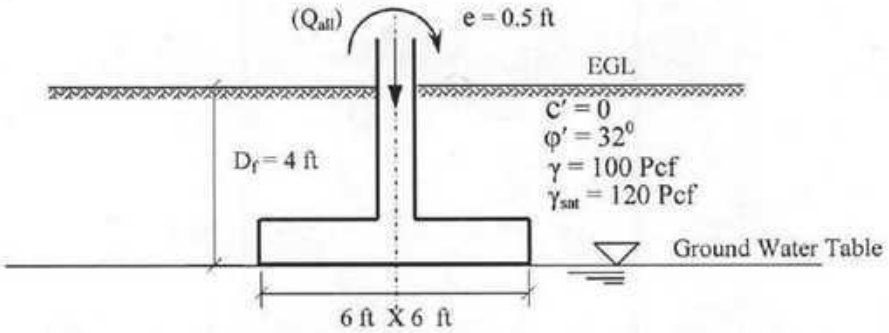
(c) Using Terzaghi's bearing capacity equation (as appropriate), calculated the preliminary allowable column load for the for the conditions as shown below. Use FS = 3. Note that no laboratory tests were conducted to obtain the shear strength of the clay formation. So, use empirical correlation to estimated design shear strength. Assume CF60 = 1.0. 7



3. (a) Using General Bearing Capacity Equation (GBCE), design the size of the square footing for the conditions as shown below. Use a factor of safety of 2.5 and $B = 2\ D_f$. 11

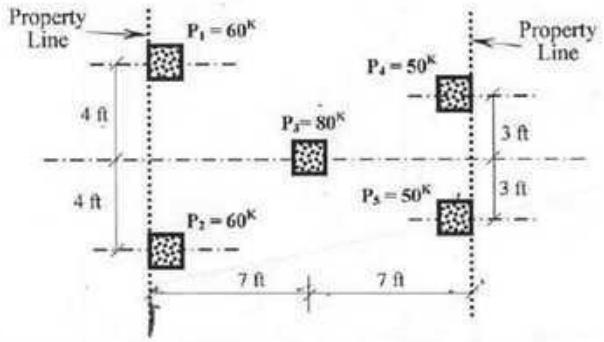


(b) An eccentrically loaded foundation is shown below. Determine the allowable load the foundation can carry. Use Meyerhof's effective area method and FS = 2.5. 9

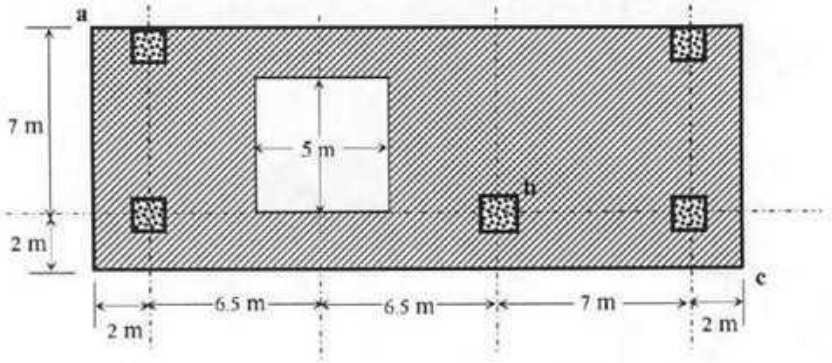


4. (a) Write down the factors considered in general bearing capacity equation which were not considered in Terzaghi's bearing capacity equation. 3

(b) Design the size of a combined trapezoidal footing for the following conditions. All columns have x-sectional dimension of 12 in by 12 in. Use q_a =3.0 ksf. 7

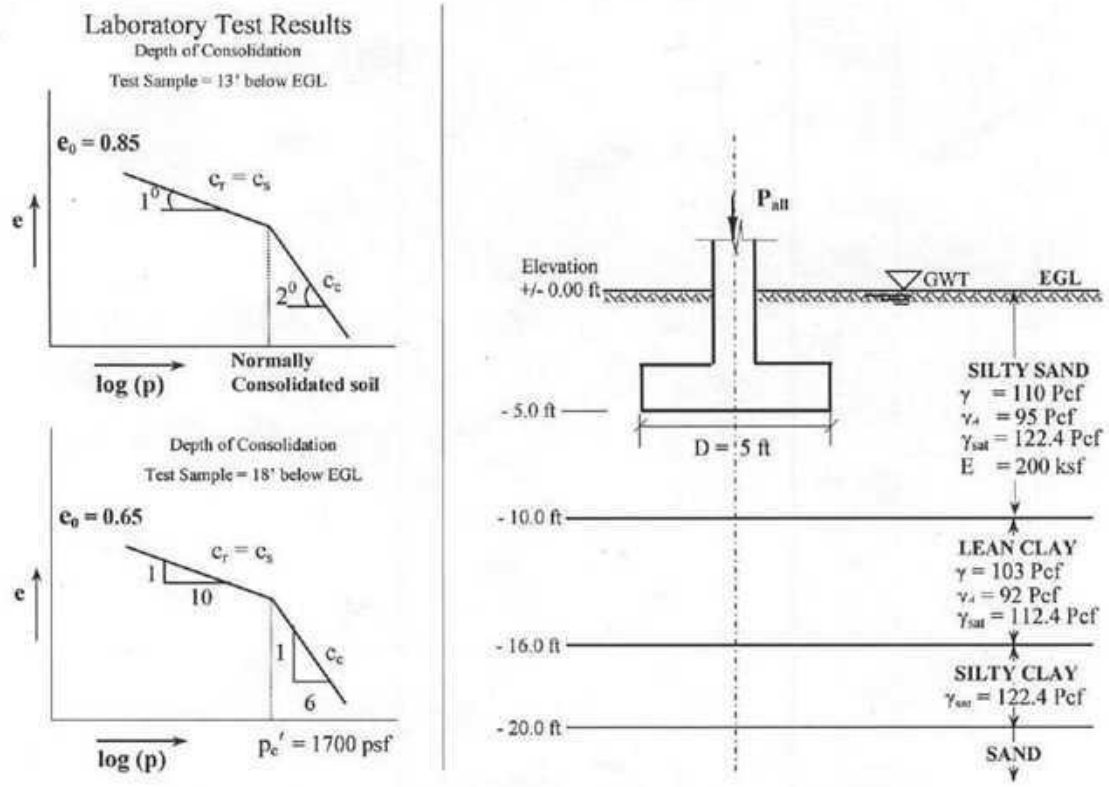


(c) The plan of a mat foundation is shown below. Column load for all conrner columns is 200 kN each and other column is 800 kN. All columns are having sizes of 400 mm by 400 mm. Calculate soil pressures at points a, b, c and at the geometric centroid of the mat foundation. 10

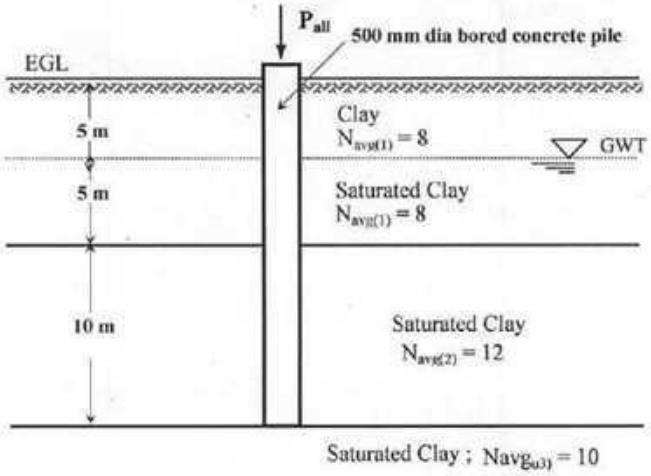


5. (a) Depict and write short notes on general and local shear failure patterns for shallow foundation. 6

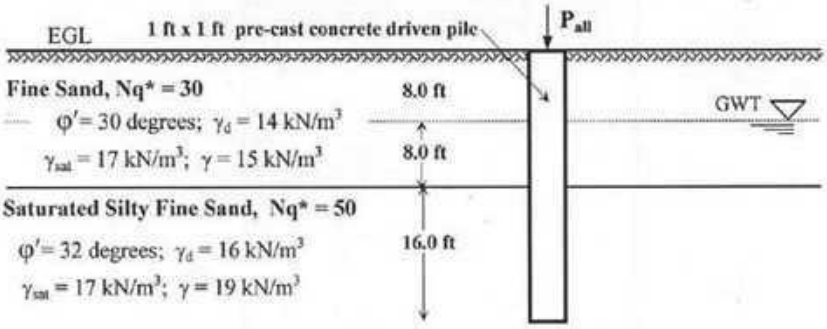
(b) A footing designed as per allowable bearing capacity based on shearing failure is shown in the following figure. Estimate settlements for both sand and clay layers. Use $q_a = p = 2.4$ ksf. 14



6. (a) For the following condition, calculate the allowable capacity of a single pile. 10



(b) For the following condition, calculate the allowable capacity of a single pile. 10



7. (a) What do you understand by shallow and deep foundations? Categorize shallow foundations. Draw sketches of different combined footings. Also categorize pile foundations. No description is required. 10

(b) Draw arrangement of group piles for the following sets of piles. 6
(i) Triple row for a wall (ii) 11 piles

(c) With sketches write short notes on cantilever retaining wall. 4

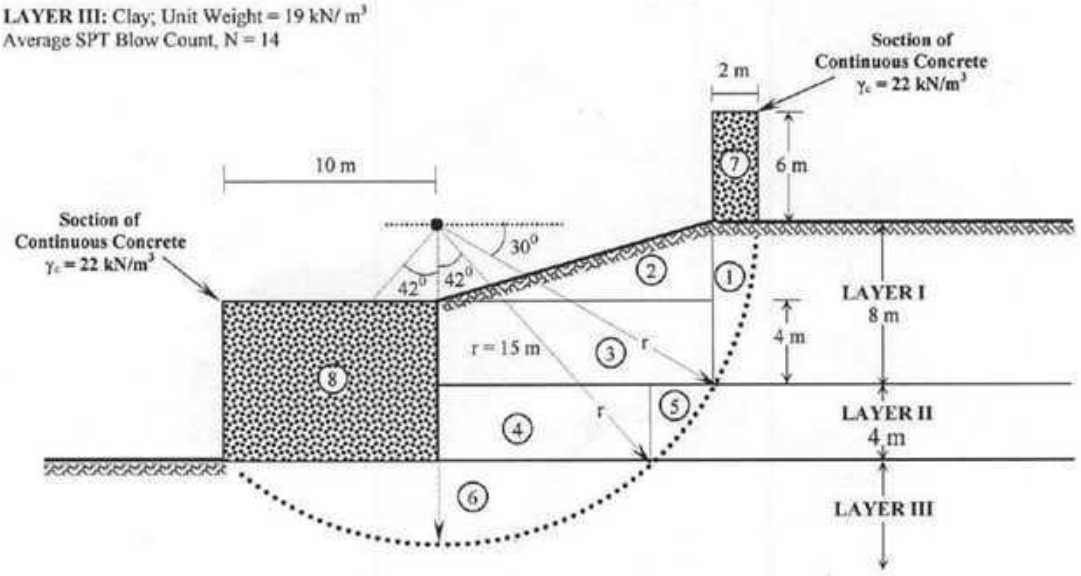
8. (a) What are the criteria for checking the stability of a retaining wall? Show with sketches the proportioning geometries for cantilever and gravity retaining walls. 7

(b) Determine the factor of safety (slope stability) against the failure arc through the slope as shown below. 13

LAYER I: Sandy Clay; Unit Weight = 17 kN/m^3
Average SPT Blow Count, N = 7

LAYER II: Clay; Unit Weight = 18.0 kN/ m^3
Average SPT Blow Count, N = 10

LAYER III: Clay; Unit Weight = 19 kN/ m^3
Average SPT Blow Count, N = 14



APPENDIX

Parameter for 60% Energy Correction For Field SPT

E_m = Hammer Efficiency (Donut + Cathed) = 0.55 to 0.60

C_B = Correction for Borehole Diameter
= 1.0 (For Dia 2.5" – 4.5")
= 1.05 (For Dia of 6")
= 1.15 (For Dia 8")

C_S = Correction for Sampler
= 1.0 Standard Sampler
= 1.2 Sampler Without Liner

C_R = Correction for Rod Length
= 0.75 for L = (3-4) m
= 0.85 for L = (4-6) m
= 0.95 for L = (6-10) m
= 1.0 for L > 10 m

Relevant Empirical Correlations

$CF_1 = \sqrt{\frac{2000}{\sigma_{v0}'}}$ (σ_{v0}' is in psf) $CF_1 = \sqrt{\frac{100}{\sigma_{v0}'}}$ (σ_{v0}' is in kPa)

$C_u = (q_{unc}/2)$

$q_{unc} = 300\ N_f$ (q_{unc} in psf)

$\phi' = 17 + \sqrt{20(N_1)_{60}}$ (ϕ' is in degree)

BEARING CAPACITY OF SOIL

(A) TERZAGHI'S ULTIMATE BEARING CAPACITY EQUATIONS

Applicable For Dense/Stiff Soil Considering General Shear Failure

c-part q-part γ-part

$$q_u = 1.3\, c\mathcal{N}_c + q_f N_q + 0.4\, \gamma_{bf} B N_\gamma$$ (For Square Foundation)

$$q_u = 1.3\, c\mathcal{N}_c + q_f N_q + 0.3\, \gamma_{bf} B N_\gamma$$ (For Circular Foundation)

$$q_u = c\mathcal{N}_c + q_f N_q + 0.5\, \gamma_{bf} B N_\gamma$$ (For Strip Foundation)

Table: Terzaghi's Bearing Capacity Factors (General Shear Failure)

φ' (degree)	N_c	N_q	N_γ
0	5.7	1.0	0.0
10	9.61	2.69	0.56
20	17.69	7.44	3.64
30	37.16	22.46	19.13
35	57.75	41.44	45.41

B) TERZAGHI'S MODIFIED ULTIMATE BEARING CAPACITY EQUATIONS

Applicable For Medium Dense/Stiff Soil Considering Local Shear Failure

$q_u = 0.867\, c' N_c' + q_f N_q' + 0.4\, \gamma_{bf} B N_\gamma'$ **(For Square Foundation)**

$q_u = 0.867\, c' N_c' + q_f N_q' + 0.3\, \gamma_{bf} B N_\gamma'$ **(For Circular Foundation)**

$q_u = 0.67\, c' N_c' + q_f N_q' + 0.5\, \gamma_{bf} B N_\gamma'$ **(For Strip Foundation)**

N_c', N_q', N_γ' = Terzaghi's Modified Bearing capacity factors (for local shear failure) that are functions only of the soil friction angle φ'

Table: Terzaghi's Bearing Capacity Factors (Local Shear Failure)

φ' (degree)	N_c'	N_q'	N_γ'
0	5.7	1.0	0.0
10	8.02	1.94	0.24
20	11.85	3.88	1.12
30	18.99	8.31	4.39
35	25.18	12.75	8.35

(C) THE GENERAL BEARING CAPACITY EQUATION

$$q_u = c' N_c F_{cs} F_{cd} F_{ci} + q_f N_q F_{qs} F_{qd} F_{qi} + 0.5\, \gamma_{bf} B N_\gamma F_{\gamma s} F_{\gamma d} F_{\gamma i}$$

F_{cs}, F_{qs}, $F_{\gamma s}$ = Shape Factors
F_{cd}, F_{qd}, $F_{\gamma d}$ = Depth Factors
F_{ci}, F_{qi}, $F_{\gamma i}$ = Inclination Factors

Table: General Bearing Capacity Factors

ϕ'	N_c	N_q	N_γ
0	5.14	1.00	0.00
10	8.35	2.47	1.22
20	14.83	6.40	5.39
26	22.25	11.85	12.54
28	25.80	14.72	16.72
30	30.14	18.40	22.40
32	35.49	23.18	30.22
34	42.16	29.44	41.06

Shape Factors

$F_{cs} = 1 + (B/L)(N_q/N_c)$
$F_{qs} = 1 + (B/L)\tan\phi'$
$F_{\gamma s} = 1 - 0.4\,(B/L)$
Where L = Length of the foundation (L>B)

Depth Factors

For $D_f/B \le 1$

$F_{cd} = 1 + 0.4\,(D_f/B)$
$F_{qd} = 1 + 2\tan\phi'(1 - \sin\phi')^2\,(D_f/B)$
$F_{\gamma d} = 1$

For $D_f/B > 1$

$F_{cd} = 1 + 0.4\tan^{-1}(D_f/B)$
$F_{qd} = 1 + 2\tan\phi'(1 - \sin\phi')^2\tan^{-1}(D_f/B)$
$F_{\gamma d} = 1$
The factor $\tan^{-1}(D_f/B)$ is in radians.

Inclination Factors

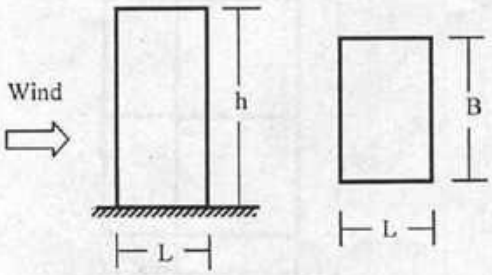
$F_{ci} = F_{qi} = (1 - \beta^0/90^0)^2$
$F_{\gamma i} = (1 - \beta/\phi')^2$
β = Inclination of the applied load on the foundation with respect to the vertical

Height z (ft)	C_G (for non-slender structures)		
	Exp A	Exp B	Exp C
0~15	1.654	1.321	1.154
50	1.418	1.215	1.097
100	1.309	1.162	1.067
150	1.252	1.133	1.051
200	1.215	1.114	1.039
300	1.166	1.087	1.024
400	1.134	1.070	1.013
500	1.111	1.057	1.005
650	1.082	1.040	1.000
1000	1.045	1.018	1.000

Height z (ft)	C_z		
	Exp A	Exp B	Exp C
0~15	0.368	0.801	1.196
50	0.624	1.125	1.517
100	0.849	1.371	1.743
150	1.017	1.539	1.890
200	1.155	1.671	2.002
300	1.383	1.876	2.171
400	1.572	2.037	2.299
500	1.736	2.171	2.404
650	1.973	2.357	2.547
1000	2.362	2.595	2.724

Category	C_1
Essential facilities	1.25
Hazardous facilities	1.25
Special occupancy	1.00
Standard occupancy	1.00
Low-risk structure	0.80

Location	V_b (mph)
Dhaka	130
Chittagong	160
Rajshahi	95
Khulna	150



h/B	L/B					
	0.1	0.5	0.65	1.0	2.0	≥ 3.0
≤ 0.5	1.40	1.45	1.55	1.40	1.15	1.10
1.0	1.55	1.85	2.00	1.70	1.30	1.15
2.0	1.80	2.25	2.55	2.00	1.40	1.20
≥ 4.0	1.95	2.50	2.80	2.20	1.60	1.25

Response Modification Coefficient, R for Structural Systems

Basic Structural System	Description Of Lateral Force Resisting System	R
(a) Bearing Wall System	Light framed walls with shear panels	6~8
	Shear walls	6
	Light steel framed bearing walls with tension only bracing	4
	Braced frames where bracing carries gravity loads	4~6
(b) Building Frame System	Steel eccentric braced frame (EBF)	10
	Light framed walls with shear panels	7~9
	Shear walls	8
	Concentric braced frames (CBF)	8
(c) Moment Resisting Frame System	Special moment resisting frames (SMRF)	
	(i) Steel	12
	(ii) Concrete	12
	Intermediate moment resisting frames (IMRF), concrete	8
	Ordinary moment resisting frames (OMRF)	
	(i) Steel	6
	(ii) Concrete	5
(d) Dual System	Shear walls	7~12
	Steel EBF	6~12
	Concentric braced frame (CBF)	6~10
(e) Special Structural Systems	According to Sec 1.3.2, 1.3.3, 1.3.5 of BNBC	

Site Coefficient, S for Seismic Lateral Forces

Site Soil Characteristics		Coefficient, S
Type	Description	
S_1	A soil profile with either: A rock–like material characterized by a shear–wave velocity greater than 762 m/s or by other suitable means of classification, or Stiff or dense soil condition where the soil depth exceeds 61 meters	1.0
S_2	A soil profile with dense or stiff soil conditions, where the soil depth exceeds 61 meters	1.2
S_3	A soil profile 21 meters or more in depth and containing more than 6 meters of soft to medium stiff clay but not more than 12 meters of soft clay	1.5
S_4	A soil profile containing more than 12 meters of soft clay characterized by a shear wave velocity less than 152 m/s	2.0

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc Engineering (Civil)

Course Title: **Transportation Engineering –II: Highway Design & Railways** Course Code: CE 451

Time: 3 Hours Full Marks: 150

There are two sections in the question paper namely "SECTION A" and "SECTION B". You have to answer from both sections according to the instruction mentioned in each section.

SECTION A
There are FOUR questions. Answer any THREE

1. (a) Elaborately explain different type of distresses in rigid and flexible pavement. Also discuss the causes of these distresses and relevant remedial measures. (20)
   (c) Explain "Pavement Serviceability Concept". (5)

2. (a) Establish a relationship between degree of curvature and versine of a curve. (7)
   (b) Write a short note on ballast cushion. (10)
   (c) Why generally the followings are favored (8)
   i) Broken Stone ii) Geo-textile.

3. (a) Discuss the classification of fixed signals. (15)
   (b) Write a short note on Marshalling yard. (5)
   (c) Briefly differentiate cant-deficiency and cant excess. (5)

4. (a) Draw a typical doweled expansion joint. (5)
   (b) Design a minimum thickness of flexible pavement (i.e. thickness of different layers) for the following traffic condition: (20)

Daily Count	Axle load(kips)
3000 (Single Axle)	8
1000 (Single Axle)	15
150(Single Axle)	32
100 (Tandem Axle)	48

Given:
Sub grade soil CBR value is 5
Design life is 12 years
Traffic growth rate is 5% per annum
Reliability is 90%
Overall standard deviation is 0.45
Design serviceability loss is 2.0
Available material:

- Hot mix asphalt surface concrete (a_1=0.44)
- Crushed stone base course (a_2=0.14, m_2=0.4 & E_2= 30 ksi)
- Crushed stone sub base (a_3=0.11, m_3=0.9 & E_3= 14.5 ksi)

Note: Use attached Figure. 1.

SECTION B

There are FOUR questions. Answer any THREE

5. (a) Describe different stress inducing factors of rigid pavement. Also explain the problems arise from these factors and suggest how these problems can be handle. (10)

   (b) Show the classification of different types of asphalt. Write a short note on "Cutback asphalt". (6+3)

   (c) What are the objectives of asphaltic concrete mix design? (6)

6. (a) Write down the functional classification of railway station. (15)

   (b) Differentiate between Station and Yard. (5)

   (c) Briefly list the important requirements of ballast. (5)

7. (a) Compare the rigid and flexible pavement systems from various criteria. (8)

   (b) Discuss the outcomes of AASHO road test. (7)

   (c) For the following data, design and draw the distributed reinforcement and tie bars for a rigid pavement. (10)

   Thickness of the rigid pavement= 9 inch
   Lane width= 11 ft, two lane
   Spacing of the transverse joint=42 ft
   Allowable stress of steel =20000 psi
   Compressive strength of concrete= 3650 psi, f = 1.5

8. (a) Show a simplified flow chart of the recovery and refining of petroleum asphalts. What are the laboratory tests of bituminous materials, used in road construction? (5+3)

   (b) An asphalt concrete surface course mixture is being designed by Marshall Method for heavy traffic. Test results for different asphalt contents are given in the following table: (17)

Asphalt content (%)	Unit wt. of specimens, (pcf)	Marshall stability (lbs)	Marshall flow value	V_a (%)	VMA (%)
4.5	150.32	1732	9.0	4.40	15.30
5.0	151.63	1785	10.0	3.10	14.90
5.5	152.88	1808	12.0	1.45	14.45
6.0	152.56	1652	15.0	0.90	15.19
6.5	151.63	1426	19.0	0.82	16.30

The maximum size of the aggregate is 1.0 inch for which the minimum VMA% should be 12% as per Marshall design criteria. Compaction, no. of blows in each end of specimen is 50. Determine the optimum asphalt content. Is the mix satisfactory? Check from the design criteria table. If not, what adjustments may be suggested? To plot data use graph paper.

Note: Use attached Table.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Irrigation and Flood Control | Course Code: CE 461

Time: 3 hours | Full Marks: 150

Section A

Answer any five (5) questions of your choice out of the following seven (7) questions of Section A

1. (a) Describe Sprinkler irrigation method along with limitations of this system. (6)

   (b) What are the basic data requirements to start an irrigation project? And also discuss the outline of the project report. (7)

   (c) Determine the required flow to cover a strip of land of 0.02 hectares in area from a tube-well with a time of 45 minutes. The infiltration capacity of the soil may be taken as 3 cm/h and the average depth of flow on the field as 12 cm. (7)

2. (a) Define the following (any two): (6)
   (i) Field irrigation requirement
   (ii) Efficiency of water use
   (iii) Available water

   (b) Derive the following relationship: (6)

   The depth of water stored in the root zone $= \left(\frac{\gamma_d \times d \times F}{\gamma_w} \right)$ meters

   Where symbols carry their usual meanings.

   (c) A stream of 130 lps was diverted from a canal and 100 lps was delivered to a field. An area of 1.6 hectares was irrigated in 8 hours. (8)
   Effective depth of root zone = 1.7 m
   Runoff loss in the field = 420 m^3
   Depth of water penetration varied linearly from 1.7 m at the head end of the field to 1.1 m at the tail end of the field
   Available moisture holding capacity of soil = 20 cm/m depth of soil
   Calculate (i) Conveyance efficiency, (ii) Application efficiency, (iii) Storage efficiency, (iv) Distribution efficiency, irrigation was started at a moisture extraction level of 50% of available moisture

3. (a) What is canal system? Draw the layout of an irrigation canal network. (6)

   (b) What is groyne? What are the differences between spur and groyne? (2+4)

   (c) An area of 300 hectares is to be irrigated from a minor channel with one outlet; C.C.A is 80% of total area. The intensity of irrigation is 50% for Rabi and 30% for Kharif crop. Taking loss in conveyance system as 5% of outlet discharge, determine the design discharge of the channel. Take outlet discharge factor for wheat season as 1500 ha/m^3/sec and for rice season 1000 ha/m^3/sec. (8)

4. (a) What is meant by "Piping" on foundation of a weir? Explain Bligh's method of safe guarding the foundation against the ill effects of piping. (6)

   (b) Using Khosla's curves, determine the following for the apron shown below: (14)
   [Assume: floor thickness = 1 m]

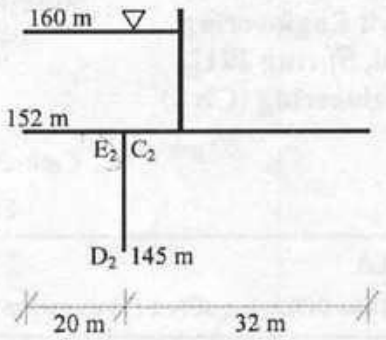


Fig. (i)

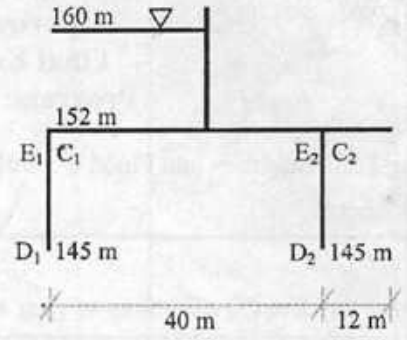


Fig. (ii)

(i) Find pressure at point C_2 only with thickness correction

(ii) Find pressure at E_2 with interference correction

Correction factor for slope, 3:1 = 4.5

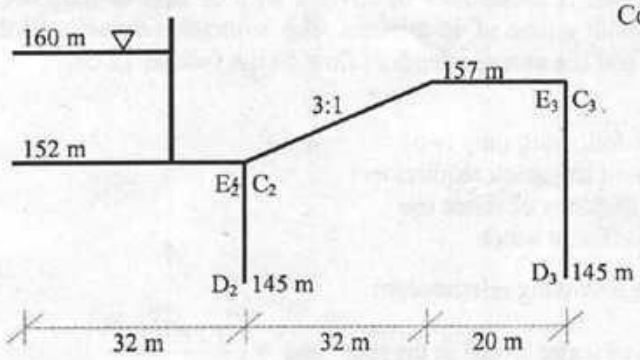


Fig. (iii)

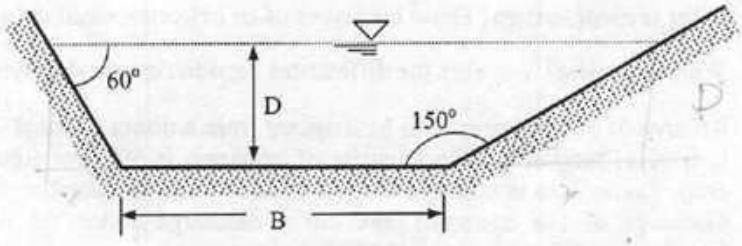
(iii) Find pressure at point C_2 with slope correction

5. (a) What are difference between barrage and weir? Draw the layout of diversion head works. (3+4)

(b) Explain canal head regulator along with its functions. (5)

(c) Find the necessary bed width (B) and water depth (D) for a channel using the following data: (8)

Full supply discharge = 10 cumec
C.V.R (m) = 1
Lacey's silt factor = 0.95
Bed slope = 1 in 5000



6. (a) What is Cross-drainage works? Differentiate between super-passage and siphon super-passage with neat sketch. (2+6)

(b) Distinguish Rapid fall and Stepped fall with neat sketch. (6)

(c) Draw the shape of Montague type of fall when its velocity and acceleration due to gravity 60 m/s and 20 m/s^2 respectively. (6)

7. (a) Distinguish between drop spillway and ogee spillway. (5)

(b) Describe a reciprocating pump with sketch along with its advantages and disadvantages. (5)

(c) Design the shape of an ogee spillway for the following data (5)

Maximum head over the crest = 5m
Height of the spillway = 15 m

Upstream face of the spillway is vertical for which constants value of k and n are 2.0 and 1.85 respectively.

(d) Determine the possible delivery head for a residential building if you purchase a centrifugal pump from the market with the following specifications: (5)

Brake Horse Power	= 35
Suction Head	= 5 m
Coefficient of friction	= 0.01
Pump efficiency	= 80 %
Pipe diameter	= 15 cm
Required delivery flow rate	= 150 l/s

Section B

Answer question no. 8 and any three (3) from the rest

8. Define Flood and Flood Management. Explain the different measures of Flood Management. (4+10)

9. Explain the following (any three) (3×4 =12)
   (i) Integrated Water Resources Management
   (ii) Process of Water logging
   (iii) Embankment
   (iv) Flood wall

10. Explain the process of salinization. How can you reclaim the salt affected soil? (4+8)

11. (a) Write down the names of the major studies and plans that shaped the water resources development of Bangladesh (6)

    (b) Write down the FAP guiding principles of Flood Management. (6)

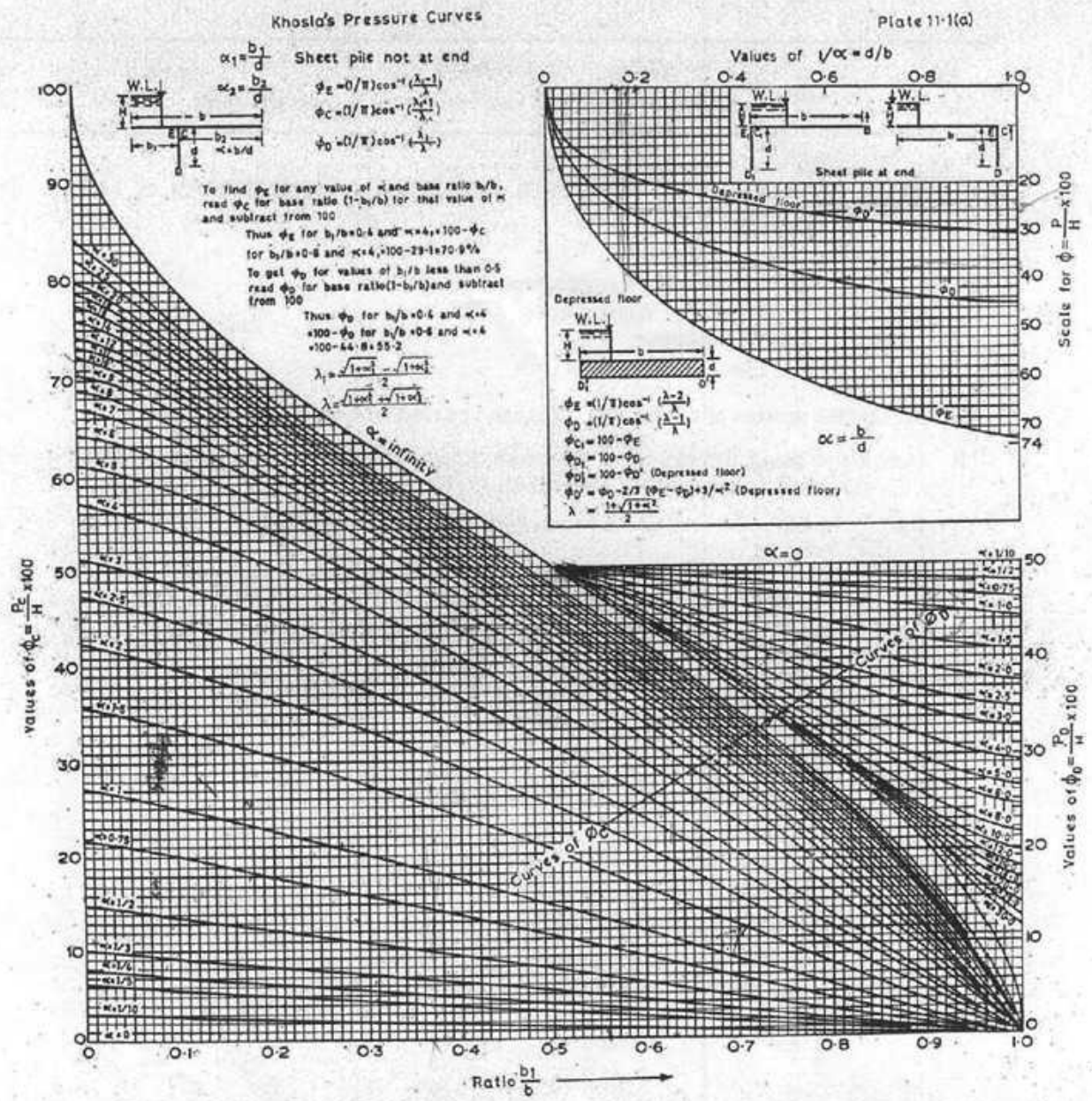
12. What is Leaching Requirement? Deduce equation for Leaching Requirement. Estimate the required depth of irrigation water to be applied to the field if the Leaching Requirement is 5% and Consumptive Use Requirement of the crop is 75 mm. (3+5+4)

13. (a) What are the advantages and disadvantages of flood control projects? (8)

    (b) Define Integrated Flood Management. (4)

Necessary equations:

- $V = C\sqrt{RS}$
- $C = \left[\dfrac{\dfrac{1}{n} + \left(23 + \dfrac{0.00155}{S}\right)}{1 + \left(23 + \dfrac{0.00155}{S}\right)\dfrac{n}{\sqrt{R}}}\right]$
- Regime slope equation,
  - $S = \dfrac{f^{3/2}}{4980 \times R^{1/3}}$
  - $S = \dfrac{f^{5/2}}{3340 \times Q^{1/6}} \Rightarrow Q = \left[\dfrac{f^{5/3}}{3340 \times S}\right]^6$
- Regime scour depth, $R = 0.47 \times \left(\dfrac{Q}{f}\right)^{1/3}$ or, $R = \dfrac{5}{2}.\dfrac{V^2}{f}$
- $V = \dfrac{1}{n} R^{2/3} \times S^{1/2}$
- $f = 1.76\sqrt{d_{mm}}$
- $Af^2 = 140 \times V^5$
- $V = \left(\dfrac{Q \times f^2}{140}\right)^{1/6}$
- $P = 4.75 \times \sqrt{Q}$
- Regime flow equation, $V = 10.8 \times R^{2/3} S^{1/3}$



1-2

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Chemistry | Course Code: CHEM 111
Time: 3 Hours | Full Marks: 150

Section-A

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

1. (a) Define proton number (Z) and mass number (A). Establish a relation between Z and A. **5**

(b) What is meant by solar system atom model? Describe the Ratherford's gold foil experiment. **10**

(c) What is Balmer spectra of hydrogen? Explain how the atomic spectra of hydrogen results on irradiation it with UV, visible and IR light. **10**

2. (a) State ionic bond. Explain how ionic bonds are formed in: **5**
i) $MgCl_2$ ii) K_2S and iii) $CaCl_2$

(b) Define 'singla bond', 'double bond' and 'triple bond' with suitable example. Draw the molecular orbital of O_2^+. **10**

(c) Discuss the valance bond theory of covalent bonding and show the formation of covalent bonds in: **10**
i) H_2, ii) HF, iii) F_2, and iv) N_2

3. (a) Define mathematically the change in internal energy (ΔE) and enthalpy (ΔH). How ΔE and ΔH are related? How a solution differs from a suspension? **5**

(b) Deduce various forms of Kirchoff's equations and thus explain why heat of reaction vary with temperature. **10**

(c) What is Hess's law? Explain the law with a suitable example. Discuss heat of formation of C_2H_5OH which cannot be determined directly by experiment but can be found by applying Hess's law. **10**

4. Write note on: **25**
i) Quantum numbers of orbital
ii) Chemical bonding by hybridization.

Section-B

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

5. (a) Differentiate between hard water and heavy water. **5**
Draw the associated structure of water.

(b) What is meant by catalytic action of water? **10**
Show the possible chemical reactions of water with basic oxides chlorides and carbides.

(c) Discuss softening of water by i) calgon process ii) permutit process and iii) ion–exchange process. **10**

6. (a) What is sol? How a sol can be distinguished from a true solution? **5**

(b) Describe the preparation of sol by peptization and Bredig,s are methods. **10**

(c) How the sols are purified by i) dialysis ii) electrodialysis and iii) ultrafiltration methods **10**

7. (a) What is wet corrosion? **5**
How wet corrosion takes place in a battery?

(b) Discuss the mechanistic aspects of dry corrosion by oxygen and hydrogen **10**

(c) What is atmospheric corrosion? Explain how i) under water corrosion and ii) microbiological corrosion occurs. **10**

8. Write note on: **25**
i) Tyndall effect and Brownian movement of colloids
ii) Pitting and differential aeration corrosion

University of Asia Pacific
Department of Civil Engineering
Semester Final Examination, Spring- 2012
Program: B.Sc. Engineering (2nd Year / 1st Semester)

Course Title: Basic Electrical Engineering **Course Code: ECE 201** **Credit: 3.00**

Time: 3.00 Hours **Full Marks: 150**

[There are eight questions. Answer any six. Figures in the right margin indicate marks]

1. (a) What is passive sign convention? Explain with example. [10]

   (b) State the following laws: [9]
   1. Ohm's Law
   2. Kirchhoff's Voltage Law (KVL)
   3. Kirchhoff's Current Law (KCL)

   (c) What is loop and mesh? [6]

2. (a) Use Nodal analysis to find 'i' in the circuit shown in Fig.2(a) [15]

   (b) What is the difference between node and super node? Draw a network containing super node. [10]

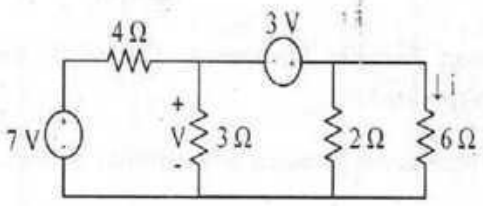


Fig: 2(a)

3. (a) Draw a network containing a super mesh. [7]

   (b) Using Mesh Circuit analysis find V in the circuit shown in Fig.3(b) [18]

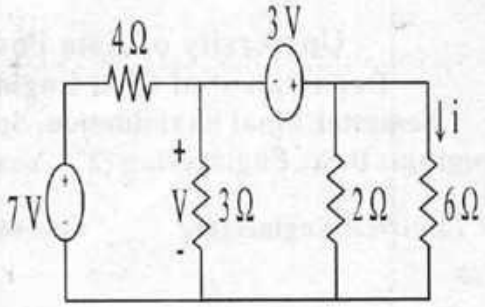


Fig. 3(b)

4. (a) State Thevenin's Theorem. [5]

(b) Find Thevenin's equivalent circuit to the left of a-b terminal of circuit shown in Fig. 4(b). [20]

Using your Thevenin's equivalent circuit find current through R_L when R_L = 6, 16 and 36Ω.

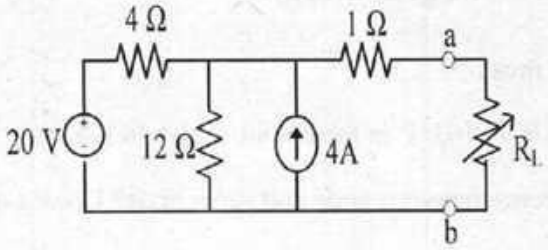


Fig. 4(b)

5. (a) State Maximum Power Transfer Theorem and prove it. Also find the expression of maximum power transferred to the load. [12]

(b) Find the equivalent resistance between a-b terminal of the circuit shown in Fig 5(b). [13]

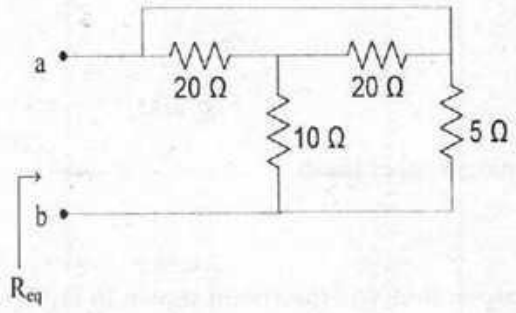


Fig.5(b)

6. (a) State superposition theorem. [5]

(b) Using superposition principle find I from the circuit shown in Fig .6(b) [20]

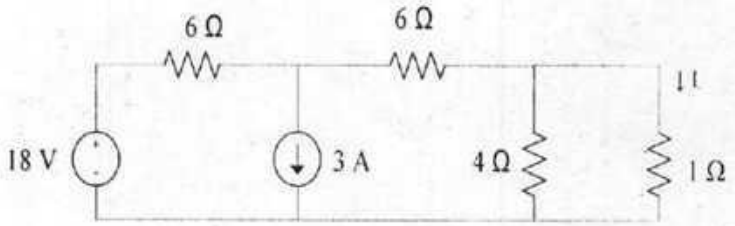


Fig. 6(b)

7 (a) What do you understand by short and open circuit conditions? [8]

(b) Using series/parallel combination find the equivalent resistance as indicated in the figure 7(b) [17]

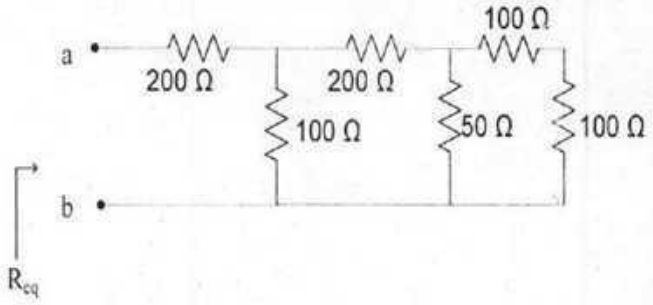


Fig. 7(b)

8 (a) Calculate the phase angle between V = 10 cos (wt + 50^0) and I = 12 sin (wt -10^0). [12]
Draw the corresponding waveform & also state which sinusoid is leading.

(b) Find the following parameters from the graph shown in the fig. 8(b) [13]
i) Amplitude ii) Time period iii) Frequency iv) Angular frequency

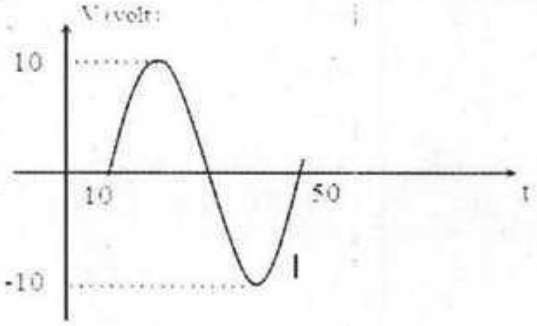


Fig. 8(b)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program : B.Sc Engineering (Civil)

Course Title: English Language -1 Course Code: HSS101
Time: 3 hours Full Marks: 50

Section – A

1. *Read* the passage *carefully* and *then* answer the *corresponding questions*.

Despite their obvious differences in length, the paragraph and the essay are quite similar structurally. For example, the paragraph is introduced by either a topic sentence or a topic introducer followed by a topic sentence. In the essay, the first paragraph provides introductory material and establishes the topic focus. Next, the sentences in the body of a paragraph develop the topic sentence. Similarly, the body of an essay consists of a number of paragraphs that expand and support the ideas presented in the introductory paragraph. Finally, a terminator – whether a restatement, conclusion, or observation – ends the paragraph. The essay, too, has a device which brings the ideas to a logically and psychologically satisfying completion: the concluding paragraph. Although exceptions of these generalisations may be observed in modern creative writing, most well written expository paragraphs and essays are comparable in structure.

Answer the questions using not more than two sentences $5 \times 0.5 = 2.5$

a) What makes a paragraph and an essay similar?
b) What is the first basic similarity between a paragraph and an essay?
c) What is the function of the introductory paragraph in an essay?
d) What is a terminator? Elaborate.
e) Are there any exceptions in writing techniques apart from the ones mentioned above? What do you think of those exceptions? Use your imagination.

Select the correct answer $5 \times 0.5 = 2.5$

a) When something is ***obvious***, it is:
   1. Hard to find
   2. Available everywhere
   3. Easy to see or understand
   4. A particular time when something happens
   5. A practice of trying to prevent something from happening

b) An ***example*** means:
   1. The quality of being extremely good
   2. Considering a study or idea very carefully
   3. Something which is extremely beautiful
   4. The outer appearance of something
   5. Something that supports what you say

c) When you ***establish*** something, you:
   1. Start or create an organisation, a system etc. that is meant to last for a long time
   2. Try to separate two or more objects from each other
   3. Actually want to make things sustain longer in a difficult situation
   4. Draw an outline of your plan
   5. None of the above

d) To ***expand*** is to:
   1. Exhibit works of art
   2. Show something in a public place for people to enjoy
   3. Use power or influence to affect somebody
   4. Become greater in size, number, or importance
   5. Carry out a scientific experiment

e) In a ***creative*** writing, you have to:
   1. Involve the use of skill and imagination
   2. Believe or say that something has a particular good quality or feature
   3. Employ a man to do the job
   4. Feel sad all the time
   5. Laugh at somebody or make rude remarks

Section B

2. Fill in *any three* of the blanks with appropriate parts of speech. $3 \times 2 = 6$

1. When you are _____ (anger) you should not take any _____ (decide).
2. Rudro _____ (careless) handled the device and it _____ (break) as a result.
3. The wind may start to blow _____ (strong) all on a sudden. We must not be _____ (worry).
4. The food of this restaurant is _____ (taste). Their _____ (special) is Bengali cuisine.
5. Most of the _____ (educate) people have a strong sense of _____ (responsible).

3. Here are some prefixes and suffixes: Over-, Un-, Re-, Dis-, For-, Il-, Mis-, -full, -less, -lv, -ing, -ence. Add either of them with *any five* of the following words and make a sentence with each of the new words. $5 \times 1 = 5$

Die, Calculate, Beauty, Call, Honest, Emerge, Give, Estimate, Safe, Literate, Mercy

4. Fill in *any four* of the blanks with appropriate homophones conforming to their respective IPA transcriptions. $4 \times 1 = 4$

i. The dish will look _____ /greɪt/ if you _____ /greɪt/ some cheese on it.

ii. I _____ /meɪd/ my _____ /meɪd/ servant rearrange all my books.

iii. You need to _____ /weɪt/ for a long time to reduce your _____ /weɪt/.

iv. It _____ /wʊd/ be very kind of you if you supply some fire _____ /wʊd/.

v. Those who have _____ /si:n/ the crime _____ /si:n/ are never going to forget about it.

vi. It is not _____ /raɪt/ to _____ /raɪt/ anything on the walls of your classroom.

5. Write *two sentences* with *any four* of the following words and their homographs. $4 \times 1 = 4$

Poor, Interest, Flat, Suit, Face, Form

6. The following excerpt has some misspelled words. Trace them out and write them correctly.

$10 \times 0.5 = 5$

I bought a new laptop receantly. Primarily I thought that I would be doing my assignments and other olice works with it. But with its portability, I now try to explor other useful arenas of a laptop. For example, I pretty much carry it wherever I go. So whenever I get a chance, I listen to my favourite songs. It recharges me in no time. Sometimes I watch movies especialy when I am on journeey as I have to move from one district to another verry frequently. When there is network covarage, I can check my e-mails to. But sometimes I get boared as laptops run out of charge pretty spon when they are used for entertainment perpose.

Section C

(Answer *any three* of the following questions. *Each question* carries *7 marks* each)
3×7= 21

7. Compare and contrast between two food courts where you have recently been. (250 words)
8. Write a paragraph describing a science fair that you have visited recently. (250 words)
9. Write a letter to your friend about your visit to a tea garden in Sylhet. (250 words)
10. Translate the following passage into English.

এক গ্রামে সুরুজ আলী নামে এক ধনী লোক বাস করতেন। তার একজন বিশ্বস্ত কাজের লোক ছিলেন। লোকটির নাম ছিল হামিদুর রহমান। হামিদুর রহমান অত্যন্ত গরীব ছিলেন। কিন্তু সে ছিল সৎ ও পরিশ্রমী। এটি ছিল গ্রীষ্মকাল। একদিন সুরুজ আলী হামিদুর রহমানকে তার বাড়ীতে ডেকে পাঠালেন। হামিদুর সেখানে পৌছালে সুরুজ আলী তাকে তার বাগানে নিয়ে গেলেন। হামিদুর সেই বাগানটি দেখাশোনা করতেন। বাগানে গিয়ে সুরুজ আলী হামিদুর রহমানকে কিছু আম পাড়তে বললেন। সেই রাতে সুরুজ আলীর কিছু বন্ধু তাঁর বাসায় বেড়াতে এল।

University of Asia Pacific
Department of Architecture/ Business Admin/ CE/ CSE/ Pharmacy
Final Examination Spring-2012
Program: B Arch/ BBA/ B.Sc Engineering/ B Pharm

Course Code: HSS 103 Course Title: English Language II Credit: 3 .00
Time: 3.00 Hours Full Mark: 50
*Marks are indicated in the right margin.

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1. Read the following passage and answer the questions that follow:

Silk is a textile that is useful as well as beautiful. It comes from the cocoon of the silkworm. There are four stages in the life of the silkworm. First there is an egg. The egg hatches and a kind of caterpillar known as a silkworm comes out. It eats, grows, and bursts out of its skin several times. It then spins a long, slender thread and winds the thread round and round its body. It goes to sleep in this silken nest or cocoon. The silkworm is now a chrysalis. Inside the cocoon the chrysalis changes into a butterfly. It then breaks out of its cocoon for the last stage of its life, as an insect. But many millions of silkworms do not live to become butterflies. To get the silk, the breeders of silkworms kill the chrysalises inside the cocoons by the use of hot steam. Every yard of silk means the death of thousands of silkworms in the chrysalis stage.

a) Answer any **five (05)** of the following questions: **1×05=05**
   1) Does silk come from a plant or an insect?
   2) How many stages are there in the life of a silkworm?
   3) Where does the silkworm go to sleep?
   4) When does the silkworm change from a chrysalis to a butterfly?
   5) Why do breeders of the silkworm kill the chrysalises?
   6) What do they use to kill the chrysalises?

b) Fill in the blanks with *from, in, inside, into, of, out of:* **1×05=05**
   1) Silk is one _____ the most beautiful textiles.
   2) What happens to the chrysalis _____ the cocoon?
   3) The silkworm bursts _____ _____ the cocoon.
   4) Silk comes _____ a cocoon.
   5) Textiles are manufactured _____ threads
   6) There are three stages _____ the life of the silkworm.

2. Rewrite any **ten (10)** of the following sentences using appropriate modal verbs: **0.5×10=05**
   a) You are suggested not to sit so close to the TV.
   b) I think I am obliged to join the meeting.
   c) A person cannot but have a driving license to drive a car.
   d) It is advised that you maintain time sincerely.
   e) Rafiq is able to do Gymnastics.
   f) You are allowed to join the picnic.
   g) Do you permit me to meet you at your office tomorrow?
   h) Perhaps I shall get the visa very soon.
   i) My uncle had the ability to help me if he did not have lost his job.
   j) You have the necessity to take a bank loan.
   k) Please join my birthday party the day after tomorrow.
   l) It is possible that there won't be any tickets left.

3. Join any **ten (10)** of the following pairs of sentences with appropriate **conjunctions** or **relative pronouns**. Do not use the same joining word more than once: **0.5×10=05**

a) There is the boy. He was calling for help.
b) I bought a watch. It stopped after two days.
c) I shall not leave the office. I shall complete my work.
d) He had an accident. He did not give the final exam.
e) The children I met today are very poor. They are very energetic.
f) Father came to meet me just before exam. I got confidence.
g) There are the policemen. They arrested the criminal.
h) I like to travel. I like to read a lot.
i) I got late to reach the office. It was raining heavily.
j) My sister wants to stay. She has to leave tomorrow morning.
k) There is a nice garden in the house. I shall take you there.
l) I heard the bad news. I could not do anything.

4. Write single sentence definition any **five (05)** of the following words: **01×05=05**

a) Genius (synonym) b)Calculator (function) c) Eagle (class) d) clock (function)
e)Bicycle (description) f) Waiter (negation)

5. Write a letter to the Registrar of your university seeking permission to organize a study tour.
Or, Write a letter to your friend describing a cultural program arranged recently by your department. **05**

6. UAP will participate in the 'National Indoor Sports Competition- 2012'. As the convener of UAP Sports Club, write a memorandum to this effect. **05**

7. UAP recently organized 1st 'Research and Development Exposition-2012'. As a reporter of a national daily, write a news-report on the event for publication in your newspaper.
Or, A team from your department recently visited a flood affected area with some relief. As the team leader, write a report to your Head of the Department about the visit. **05**

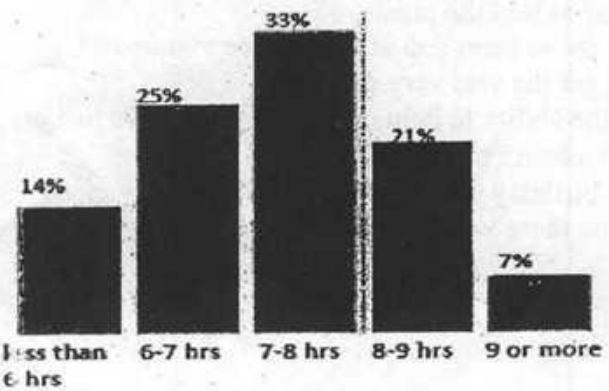
UAP

8. Write a paragraph on any **one (1)** of the following topics (word limit 130 words) **05**

a) Role of Media in Our Life b) Your Dream House c) A Memorable Journey

9. The bar chart below shows information about average hours of sleep by adults in South Asia. Describe and analyze in your own words the information available in the chart. **05**

Average hours of sleep by adults in South Asia



University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Spring 2012
Program: B.Sc. Engineering (Civil, Computer Science, Electrical and Electronic)

Course Title: Bangladesh Studies: Society and Culture **Course Code: HSS 111(a), HSS 211(a) for CE**
Credit: 2.00

Total Time: 2 Hours **Full Marks: 100**

There are two sections in the question paper namely "SECTION A" and "SECTION B". You have to answer from both sections according to the instruction mentioned in each section.

SECTION A

There are **FIVE** questions in this section. Answer **ANY FOUR** (4 x 20)

1. Define Social stratification. Mentions its characteristics. Discuss on slavery and estate system.
2. What are the factors those influence the stratification pattern of rural Bangladesh. Discuss accordingly.
3. Define political institution. Discuss the general functions of a modern government. Show the difference between monarchy and dictatorship.
4. Discuss on the economic arrangements of the pre-industrial and industrial societies.
5. Define over-urbanization. Show with relevant data the nature of urbanization in the developing countries including Bangladesh.

SECTION B

There are **THREE** questions in this section. Answer **ANY TWO** (2 x 10)

6. Democracy is only possible in a relatively affluent society where a large proportion of the people are well-housed and well-fed – Discuss.
7. Discuss on any one social problem of Bangladesh. Justify by referring to your research experience.
8. Define caste and social class. Discuss on different types of caste and class.

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Spring 2012
Programme: B.Sc. Engineering (Civil, Computer Science, Electrical and Electronic)

Course Title: Bangladesh Studies: History **Course Code: HSS 111(b), HSS 211(b) for Civil**

Credit: 2.00

Total Time: 2 Hours **Full Marks: 100**

There are two sections in the question paper namely "SECTION A" and "SECTION B". You have to answer from both sections according to the instruction mentioned in each section.

SECTION A

There are **FIVE** questions in this section. Answer **ANY FOUR** (4 x 20)

1. Explain the causes of the battle of Palashi. Why did Sirajuddaullah defeat in this battle?
2. Briefly describe the major social and religious reforms of Raja Rammohun Roy.
3. Why did Lord Curzon partition Bengal in 1905? What were the reactions of the Bengalees to it?
4. What was the demand of Eastern Bengal about the State language? Give a brief description of the Language Movement of 1952.
5. What were the Six Points of Awami League? What was its importance in the emergence of Bangladesh?

SECTION B

There are **THREE** topics in this section. Write short notes on **ANY TWO** (2 x 10)

6. Shayesta Khan
7. Bara Bhuiyans
8. Permanent Settlement.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program : B.Sc Engineering (Civil)

Course Title: Principles of Management | Course Code: IMG 301
Time: 2 hour | Full Marks: 100

Answer any 6 (Six) of the following questions. All questions are of equal value.

01. Define and explain management. "All managers' carryout managerial functions, but the time spent for each function may differ"-discuss. What are the differences between productivity, effectiveness and efficiency?

02. Discuss the various types of skills essential for managers. How do the required managerial skills differ in the organizational hierarchy? Why you need to study management as a student of civil engineering department?

03. Discuss the relationship between objectives and the organizational hierarchy. Define & explain strategy. Discuss the TOWS Matrix for strategy formulation.

04. What do you mean by formal and informal organization? How authority is delegated and what are the processes of delegation? Discuss the advantages and limitations of decentralization.

05. Define leadership. Discuss the ingredients of leadership. Show managerial grid to describe managerial styles.

06. What is meant by controlling? Discuss the system and process of controlling. Briefly discuss the control techniques.

07. What do you mean by 'time management'? Why you need to study 'time management'? Describe the process of 'time management'.

08. Write short note on any four of the following:
(a) MBO, (b) Decision making, (c) HRM, (d) Motivation, (e) MIS, (f) Ethics in business,

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring 2012
Program : B.Sc Engineering (Civil)

Course Title: Mathematics I
Time: 3 hrs

Course Code: MTH 101
Full Marks: 150

There are two sections in the question paper namely "***SECTION A***" and "***SECTION B***". You have to answer from both sections according to the instruction mentioned in each section.

SECTION A

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

Q1. (a) State and prove Rolle's theorem. 12.5

(b) Verify this theorem for the function $f(x) = x^2 - x + 2$ on $(0, 1)$. 12.5

Q2. (a) State and prove Cauchy's Mean value theorem (MVT). 12.5

(b) Verify this theorem for $f(x) = x^2 + x + 1$ and $g(x) = x^2 + 2x + 1$ on the interval $[1, 2]$. 12.5

Q3. (a) Let $f(x) = x^3 - 2x^2 + 1$. Find the intervals on which the function $f(x)$ is increasing, decreasing, concave up and concave down. 12.5

(b) Find the local extrema of $f(x) = \sin x\,(1 + \cos x)$. 12.5

Q4. (c) State Taylor's theorem with remainder. Use Taylor's theorem to expand $f(x) = \cos x$ in powers of $x - \pi/2$ with the remainder term. 12.5

(b) State and prove L'Hospital's rule. Apply this rule to evaluate 12.5

$$\lim_{x \to 0}\left(\frac{\tan x - \sin x}{x^3}\right).$$

$x \to 0$

SECTION B

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

Q5. (a) Integrate the following 15

(i) $\int (a+bx)^n dx$ (ii) $\int \frac{dx}{\sqrt{(x-2)(3-x)}}$ (iii) $\int \tan^5 x\, dx$

(b) Find a reduction formula for $\int x^3 e^{ax}\, dx$ 10

Q6. a) State and prove the fundamental theorem of calculus. 6

b) Define reduction formula. Find a reduction formula for $\int \sin^n x\, dx$. 9

(c) Evaluate (i) $\int_0^{\frac{\pi}{2}} \frac{dx}{3+2\cos x}$ (ii) $\int_0^1 \frac{dx}{1+x^2}$ 10

Q7. (a) Find the arc length of the curve $y = \ln\frac{e^x - 1}{e^x + 1}$ from $x = 1$ to $x = 2$. 12.5

(b) Find the area of the region that is inside the cardioid $y = 4(1+\cos\theta)$ and outside the circle $r = 6$. 12.5

How $y = r\sin\theta$???

Q8. (a) Find the area of the region enclosed by the curves $y^2 = 4ax$ and $x^2 = 4ay$ 9

(b) Find the area of the region bounded by $y^2 = x$, $y = 2 - x$. 8

(c) Find the volume of the solid generated by the revolution of an ellipse and its minor axis. 8

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring 2012
Program : B.Sc Engineering (Civil)

Course Title: Mathematics-II
Time: 3 hours

Course Code: MTH-103
Full Marks: 150

N.B. Answer any **three (3)** questions from each of the following group.

Group A

1. (a) Prove that the section of a sphere by a plane is circle and to find its radius and center. 15

(b) Find the equation of the sphere passing through the points $(a, 0, 0)$, $(0, b, 0)$, $(0, 0, c)$ and $(0, 0, 0)$. 10

2. (a) Find the equation of the sphere whose center is $(2, 3, 1)$ and tangent to the plane $6x - 3y + 2z - 8 = 0$. 12

(b) Find the equation of the tangent plane of the spheres $x^2 + y^2 + z^2 - 4x + 2y = 4$, which are parallel to the plane $2x - y + z = 1$ and also find the co-ordinates of the points of contact. 13

3. (a) Find the equation of the sphere through the circle $x^2 + y^2 + z^2 = 9$, $2x + 3y + 4z = 5$ and the point $(1, 2, 3)$. 13

(b) Find the value of 'a' for which the plane $x + y + z = a\sqrt{3}$ touches the sphere $x^2 + y^2 + z^2 - 2x - 2y - 6 = 0$. 12

4. (a) Discuss the geometrical interpretation of scalar product of two vectors. 15

(b) Prove that $(\vec{a} \times \vec{b})^2 = a^2 b^2 - (\vec{a} \cdot \vec{b})^2$ 10

Group B

5. **(a)** Discuss the geometrical interpretation o the cross product of two vectors. 10

(b) Determine the scalar triple product of three vectors. 15

6. **(a)** Determine the value of 'a' so that $2\bar{i}+a\bar{j}-4\bar{k}$ and $5\bar{i}+2\bar{j}+3\bar{k}$ are perpendicular to each other. 7

(b) If $\vec{a}=\bar{i}+2\bar{j}-3\bar{k}$, $\vec{b}=2\bar{i}-\bar{j}+\bar{k}$, $\vec{c}=-\bar{i}+3\bar{j}-2\bar{k}$, find $(\vec{a}\times\vec{b})\times(\vec{b}\times\vec{c})$ and also the magnitude. 8

(c) Determine a unit vector perpendicular to the plane of $\vec{A}=3\bar{i}-5\bar{j}+\bar{k}$ and $\vec{B}=2\bar{i}-4\bar{j}-7\bar{k}$. 10

7. **(a)** Discuss the differentiation of scalar triple product. 10

(b) Define gradient of a scalar point function, divergence of a vector function and curl of a vector function. 9

(c) Prove that $div(\vec{u}-\vec{v})=div\,\vec{u}-div\,\vec{v}$ 6

8. **(a)** Prove that $curl(\varphi\vec{r}) = grad\varphi\times\vec{r}+\varphi\,curl\,\vec{r}$ 6

(b) Find the divergence of the vector point function $(x^3, xy^2, -\ln z)$ 6

(c) Find the directional derivative of $\varphi=4xy-3x^2z^2$ at (2, -1, 2) in the direction $2\bar{i}-3\bar{j}+6\bar{k}$ 13

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring 2012
Program : B.Sc Engineering (Civil)

Course Title: Mathematics III — Course Code: MTH 201
Time: 3 hrs — Full Marks: 150

There are two sections in the question paper namely "***SECTION A***" and "***SECTION B***". You have to answer from both sections according to the instruction mentioned in each section.

SECTION A

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

1. (a) Define basis and dimension. Let U be the subspace of R^3 spanned by the vectors $(1,2,1)$, $(2,1,-1)$ and $(7,-4,1)$. Find a basis and dimension of U. 13

(b) Find the rank of the matrix A where 12

$$A=\begin{pmatrix} 1 & 3 & 1 & -2 & -3 \\ 1 & 4 & 3 & -1 & -4 \\ 2 & 3 & -4 & -7 & -3 \\ 3 & 8 & 1 & -7 & -8 \end{pmatrix}.$$

2. (a) Determine whether or not the following form a basis for the vector space R^3:
(i) $(1,1,1)$, $(1,2,3)$ and $(2,-1,1)$. (ii) $(1,1,2)$, $(1,2,5)$ and $(5,3,4)$. 10

(b) Let V and W be the following subspaces of R^4.

$$V=\{(a,b,c,d): b-2c+d=0\}$$

$$W=\{(a,b,c,d): a=d,\quad b=2c\}$$

Find a basis and the dimension of (i) V (ii) W and (iii) $V\cap W$. 15

3. (a) Define the kernel and the image of a linear transformation. Let $T: R^4 \to R^3$ be a linear transformation defined by

$$T(x,y,s,t)=(x-y+s+t,\ x+2s-t,\ x+y+3s-3t).$$

Find a basis and the dimension of the kernel of T and the image of T. 15

(b) Let S and T be the linear operators on R^2 defined by $S(u,v)=(0,u)$ and $T(u,v)=(u,0)$. Show that $TS=0$ but $ST\neq 0$. Also show that $T^2=T$. 10

4. (a) Define eigenvalues and eigenvectors. Determine the eigenvalues of the matrix 15

$$A=\begin{pmatrix} 1 & 1 & 2 \\ 0 & 2 & 2 \\ -1 & 1 & 3 \end{pmatrix}$$

(b) Let S and T be the linear operators of R^2 into R^2 defined by $S(u,v)=(3u+2v,-6u+v)$ and $T(u,v)=(2u+v,u-v)$. Find **(i)** $(ST)(u,v)$ **(ii)** $S^2(u,v)$ 10

SECTION B

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

5. **(a)** What do you know about mean, median and mode? 10

(b) In an examination of 675 candidates the examiner supplied the following information:

Marks obtained	No. of candidates
Less than 10%	7
Less than 20%	39
Less than 30%	95
Less than 40%	201
Less than 50%	381
Less than 60%	545
Less than 70%	631
Less than 80%	675

Calculate the mode and median of the percentage marks obtained. 15

6. **(a)** What is variance and standard deviation? Compute the standard deviation for the following frequency distribution. 15

Mass in Kg	60-62	63-65	66-68	69-71	72-74
No. of students	5	18	42	27	8

(b) What do you know about permutation and combination? Suppose 7 female and 5 male applicants have been successfully screened for 4 positions. In how many ways can the following compositions be selected? (i) 2 female and 2 males (ii) 4 females (iii) 4 people regardless of sex (v) At least 3 females. 10

7. **(a)** What do you mean by probability? A bag contains 5 white and 6 reds balls. Two balls are drawn successively at random from the bag. What is the probability that both the balls are white when the drawings are made (i) with replacement? and (ii) without replacement? 7

(b) A student takes his examination in four subjects A, B, C and D. He estimates his chances of passing in A as 4/5, in B as 3/4, in C as 5/6 and in D as 2/3. To qualify, he must pass in B and at least two other subjects. What is the probability that he qualifies? 8

8. **(a)** The probability that a contractor will get a plumbing contract is 2/3 and the probability that he will not get an electric contract is 4/9. If the probability of getting at least one contract is 3/5, what is the probability that he will get both? 6

(b) A bag contains 15 identical balls of which 7 are white and the rest are black. Three balls are drawn at random from the bag. What is the probability that both the balls are white? 6

(c) A die is thrown 8 times and it is required to find the probability that 3 will show (i) Exactly 2 times (ii) At least seven times (iii) At least once. 8

The End

UNIVERSITY OF ASIA PACIFIC
Department of Basic Sciences and Humanities
Final Examination, Spring-2012
Program: B.Sc. Engineering (Civil)

Course Title: Mathematics IV
Time: 3.00 Hrs.

Course Code: MTH-203
Full Marks: 150

There are two sections in the question paper namely "*SECTION A*" and "*SECTION B*". You have to answer from both sections according to the instruction mentioned in each section.

SECTION A

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

1. (a) Define Fourier series in the interval $[-l, l]$. Determining the coefficient of

a_0, a_n and b_n in Fourier series. 15

(b) Derive the complex form of the Fourier series. 10

2. (a) Obtain the Fourier series of the function $f(x)=\begin{cases}0, & -\pi \le x \le 0\\ 1, & 0 \le x \le \pi\end{cases}$ 17

(b) Find the Fourier integral of the function $f(x)=e^{-kx}$ when $x>0$ and $f(-x)=f(x)$, and

Hence, prove that $\int_0^\infty \frac{\cos ux}{k^2+u^2}du=\frac{\pi}{2k}e^{-kx}$. 15

3. (a) Define finite Fourier sine and cosine transform. Find the Fourier cosine transform of the

Function $F(x)=e^{-x^2}$. 15

(b) Find the Fourier transform of $f(x)$ defined by $f(x)=\begin{cases}1 & |x|<a\\ 0 & |x|>a\end{cases}$ 10

4. (a) Write down the statement of second shifting property. Find $L\{F(t)\}$, if 17

$$F(t)=\begin{cases}\cos(t-\frac{2\pi}{3}), & t>\frac{2\pi}{3}\\ 0, & t<\frac{2\pi}{3}\end{cases}$$

(b) Find the Laplace transform of $\int_0^\infty \frac{\sin t}{t}dt$ 15

SECTION B

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

5. (a) Define Laplace transform for the function $F(t)$. 5

(b) Find the Laplace transform of e^{at} and $\cos at$. 10

(c) Use the definition of Laplace transform to find $L\{t^n\}$ and $L\{t\sin at\}$. 10

6. (a) Solve the following equation using Laplace inverse transform

$$Y'' - 3Y' + 2Y = 4e^{2t},\ Y(0) = -3,\ Y'(0) = 5,\ \text{where } Y' = \frac{dY}{dt}$$ 12

(b) Find $L^{-1}\left\{\dfrac{s^2 - 2s + 3}{(s^3 + 2s + 2)(s^2 + 2s + 5)}\right\}$ 8

(c) Find $L^{-1}\left\{\dfrac{6s - 4}{(s^2 - 4s + 20)}\right\}$ 5

7. Find the general solution of the following differential equations 10 - 15

(a) $\dfrac{d^2y}{dx^2} + 2\dfrac{dy}{dx} + 5y = 6\sin 2x + 7\cos 2x.$

(b) $\dfrac{d^2v}{dx^2} - 2\dfrac{dy}{dx} - 3y = 2e^x - 10\sin x.$

8. Solve the following differential equations 10 - 15

(a) $(2xy^2 + y)dx + (2y^2 - x)dy = 0.$

(b) $x^2\dfrac{d^2y}{dx^2} - 2x\dfrac{dy}{dx} + 2y = x^3.$

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Spring-2012
Program: B.Sc Engineering (Civil)

Course Title: Physics I | Course Code: PHY-101 | Credit: 3.00
Time: 3.00 Hours | Full Mark: 150

*[N.B- The figures in the margin indicate full marks. There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". Answer from both sections according to the instruction mentioned in each section.]*

SECTION A

There are **FOUR** questions. Answer any **THREE**

Marks

1. (a) Derive the necessary conditions for the formation of Newton's ring by reflected and transmitted light. 15

   (b) A thin equiconvex lens of focal length 4 metres and refractive index 1.5 rests on and in contact with an optical flat and using light of wavelength 5460 Å. Newton's rings are viewed normally by reflection. What is the diameter of the 5th bright ring? 10

2. (a) What is interference of light? 5

   (b) Describe the conditions for constructive and destructive interference by deriving the intensity equation $I = 4a^2 \cos^2 \frac{\delta}{2}$. 20

3. (a) Prove the equation of Newton's formula for velocity of sound in gasses; $V = \sqrt{\frac{P}{\rho}}$, where the symbols have their usual meanings. 15

   (b) Discuss the effect of temperature on the velocity of sound in gas. 10

4. (a) Derive the equation of Doppler effect when the observer at rest and source in motion. 15

   (b) Two trains traveling in the opposite direction at 100 km/hr each, cross each other while one of them is whistling. If the frequency of the note is 800 Hz, find the apparent pitch as heard by an observer in the other train: 10
   (i) before the trains cross each other
   (ii) after the trains have crossed each other

[Turn over

SECTION B

There are **FOUR** questions. Answer any **THREE**

Marks

5. (a) Derive the necessary conditions under which elliptically and circularly polarized light are formed by deriving the general equation of ellipse, $\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{2xy}{ab}\cos\delta=\sin^2\delta$. 15

(b) Show that at Brewster's angle the reflected and refracted rays are at right angles to each other. 10

6. (a) Prove the law of Malus, $I \propto \cos^2\theta$, where the symbols have their usual meanings. 15

(b) Write short notes on half and quarter waveplate. 10

7. (a) Show that the moment of inertia of a ring is $I = MR^2$, where the symbols have their usual meanings. 15

(b) A solid sphere of mass 1 kg and radius 0.25 m rolls without slipping with a uniform velocity of 0.1 m/s along a straight line on a horizontal table. Calculate its kinetic energy. 10

8. (a) Show that the moment of inertia of a uniform rod is $\frac{1}{12}ML^2$, where the symbols have their usual meanings. 15

(b) A thin metal ring of diameter 0.6 m and mass 1 kg starts from rest and rolls down an inclined plane. Its linear velocity on reaching the foot of the plane is 5 m/s. Calculate (i) the moment of inertia of the ring and (ii) the kinetic energy of rotation at that instant. 10