University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Principles of Accounting | Credit Hours: 2.0 | Course Code: ACN 301
Time: 2 hours | Full Marks: 50

There are six questions. Answer **Question no. 6 (six)** and **any 3 (three)** from the rest.
Marks of each question are shown in the right margin.

1. (a) What is Cost Classification? Why are costs classified? [5]
   (b) Explain the behavioral classification of cost. [5]

2. Y – Ltd. produces a single product. Various cost and sales data of Y – Ltd. for the just completed year 2011 are given below: [10]

Production in units	30,000
Sales	Tk. 14,30,000
Selling price per unit	Tk. 55

Costs:	Taka
Raw materials purchased	4,80,000
Advertising Expenses	1.10,000
Entertainment and travel	45,000
Direct labor	98,000
Indirect labor	85,000
Building rent (Production uses 80% of the space; administrative and sales offices use the rest)	40,000
Utilities factory	1,08,000
Royalty paid for use of production patent, Tk. 1.5 per unit produced	?
Maintenance, factory	16,800
Rent for special production equipment Tk. 7,000 per year plus Tk. 0.30 per unit produced	?
Selling and administrative salaries	2,20,000
Other factory overhead costs	19,200
Other selling and administrative expenses	20,000

	Beginning of the year	End of the year
Inventories:		
Raw materials	Tk. 20,000	Tk. 30,000
Work in process	Tk. 40,000	Tk. 30,000
Finished goods	0	?

You are required to prepare:
(a) A schedule of cost of goods manufactured.
(b) Income statement for the year 2011.

3. (a) Distinguish between Marginal Costing Technique and Absorption Costing Technique? [2]
   (b) A company manufactured 10,000 units of product in the year 2009 for home consumption and sold at a price of Tk.8.50 per unit. In the year 2010, there is a fall in the demand for home market, which can consume 10,000 units only at a sale price of Tk.7.44 per unit. The analysis of the cost per 10,000 units is: [8]

   Materials Tk. 30,000, Wages Tk. 22,000,
   Fixed Overheads Tk. 16,000, Variable Overheads Tk. 12,000.

   The foreign market is explored and it is found that this market can consume 20,000 units of the product if offered at a sale price of Tk.7.10 per unit. It is also discovered that for additional 10,000 units of the product (over initial 10,000 units) that fixed overheads will increase by 10%.

   Is it worthwhile to try to capture the foreign market? Show calculations in support of your decision.

4. (a) What do you mean by C-V-P Analysis? [2]

(b) Mr. Karim has recently opened a chain shop in Dhaka city. The shops carry many styles of shoes that all are sold at the same price. The following are the information relating to cost and revenue for the shops: [8]

Variable Cost per pair:
Direct Material Tk.100, Direct Labor Tk.70, Overhead Tk.30

Fixed Cost per year:
Rent Tk.1,50,000, Salaries Tk.1,00,000, Advertisement Tk.50,000

Selling Price Per Unit Tk. 350

Required:
(i) Calculate the annual Break-even point in Taka and in unit.
(ii) What would be the amount of profit and margin of safety when sales is 2,500 units?
(iii) What sales level in units and Taka is required to earn a profit of Tk.60,000?
(iv) Rahim decided to increase the salary by Tk.25,000 and advertisement by Tk.20,000 to increase sales. What would be the BEP in Taka and unit if the decision were implemented?

5. Write short notes on **any 4 (four)** of the following: [10]
   (a) Accounting Equation
   (b) Double entry system
   (c) Trial Balance
   (d) Accounting Cycle
   (e) Job costing versus Process costing
   (f) Accounting process

6. The 'Z' company sales printing equipment to customers. The ending inventory on hand at June 30, 2011 had a cost of Tk. 40,000. The Trial Balance of the company is shown below

Heads of Accounts	Debits (Tk.)	Credits (Tk.)
Cash	20,000	
Accounts receivable	35,000	
Opening inventory	30,000	
Sales supplies on hand	5,000	
Prepaid fire insurance	1,000	
Land	42,000	
Office equipment	40,000	
Accounts payable		48,000
Capital		1,01,000
Sales		2,15,000
Sales Discount	3,500	
Returns & Allowances	2,800	2,000
Purchase	1,12,000	
Purchase Discount		2,000
Heat and light expenses (selling)	2,000	
Sales salaries expense	30,000	
General selling expenses	2,000	
General office expense	5,000	
Office salaries expense	20,000	
Delivery expenses	4,000	
Telephone expense	2,500	
Rent expenses (Office)	5,000	
Rent expenses (Selling)	6,000	
Interest	1,200	1,000
Total =	369,000	369,000

Additional data as of June 30, 2011
(i) Prepaid fire insurance expired Tk.500
(ii) Sales supplies consumed Tk. 2,500
(iii) Depreciation on office equipment Tk.4,000
(iv) Accrued sales salaries Tk. 5,000
(v) Accrued office salaries Tk.4,500

You are required to prepare:
(a) Classified Income Statement [10]
(b) Classified Balance Sheet [10]

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
B. Sc. Engineering (Civil)

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

Section A

[Answer **any 6 (Six)** of the following **7 (Seven)** questions]

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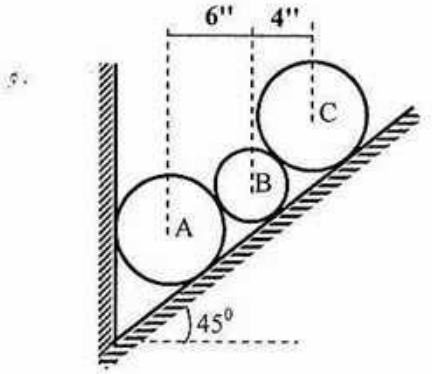
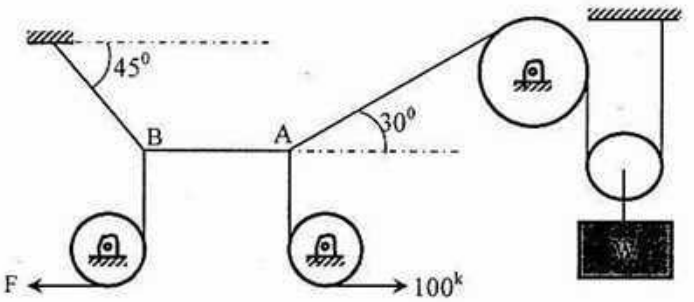
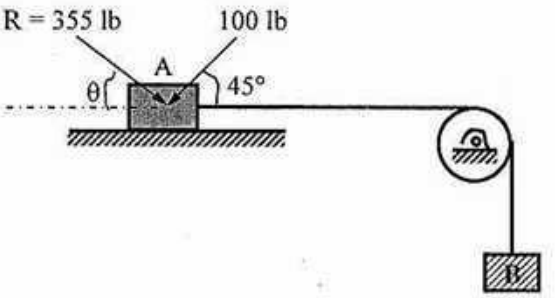
1. In the figure below, the weight of sphere A, B and C is 100 lbs each and diameters of A, C and B is 8", 8" and 5" respectively. Calculate the reactions at the contact surfaces of B and C with the inclined plane.



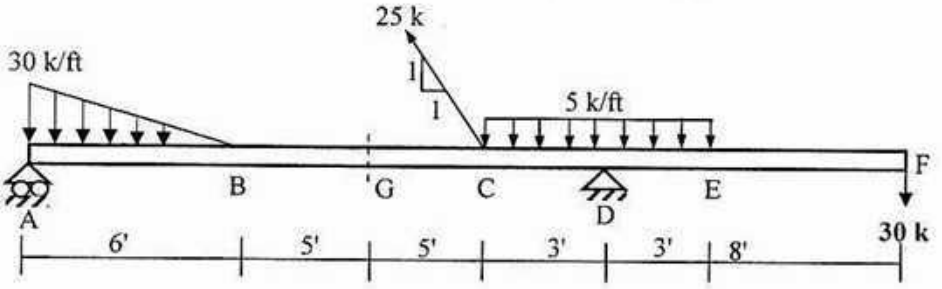
2. In the figure below, find W and F so that the cable AB remains horizontal.



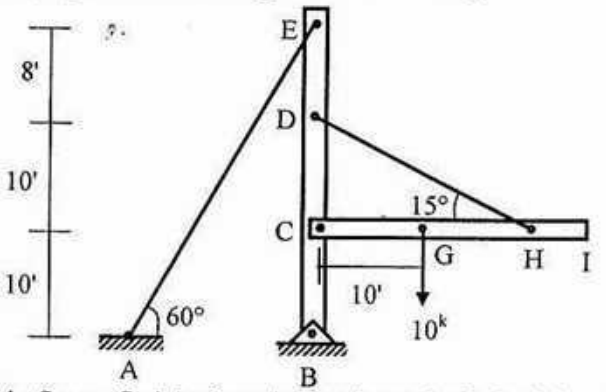
3. In the following force system weight of box **A** is 200 lb and normal force is 50 lb. Calculate the weight of the box **B** and the angle **θ**.



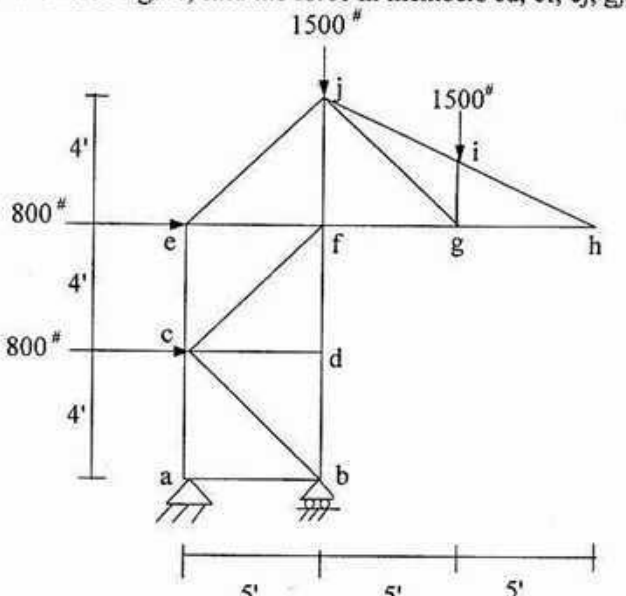
4. Determine the support reactions at **A** and **D** of the beam shown in the figure below. Also calculate the axial force, shear force and bending moment at point **G**.



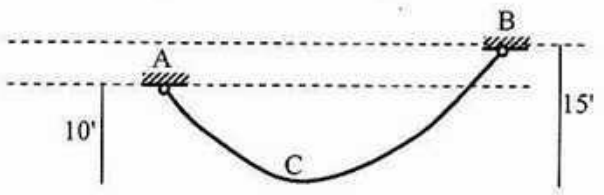
5. Calculate the force in cables AE and DH in the structure shown below. Also calculate the support reaction at B (Neglect the self-weight of the members).



6. For the truss shown in figure, find the force in members cd, cf, ej, gj, ig and ac.



7. Calculate the slopes at the supports, length of the parabolic cable and the maximum and minimum tensions in the cable. The distance between the supports is 300ft. Given that w = 0.25 #/ft.

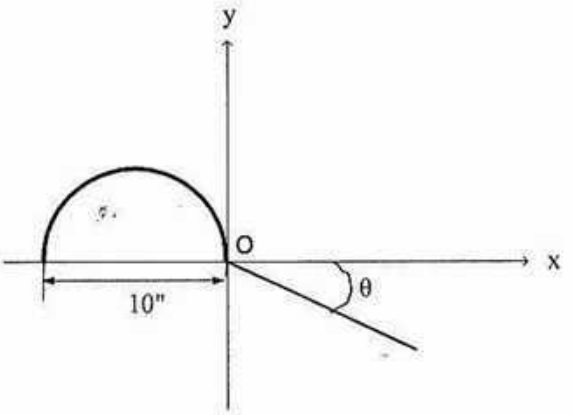


Section B

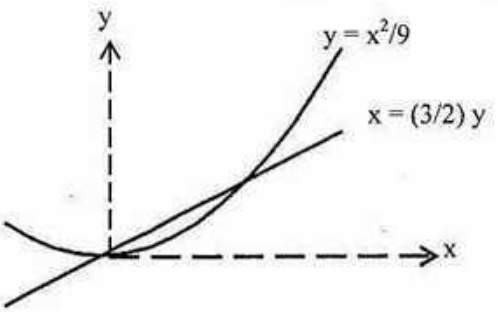
[Answer **any 4 (Four)** of the following **6 (Six)** questions]

8. 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.

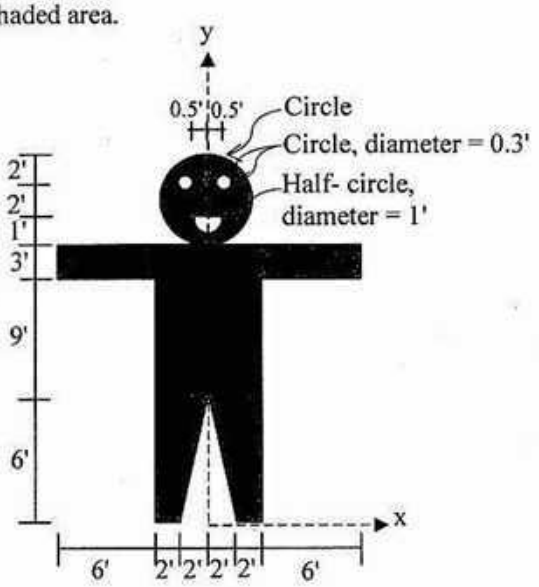
9. Determine the values of l (the length of the straight line) and the angle θ. Given that, the centroid of the composite lines is at the point O, connecting the half circle and the straight line.



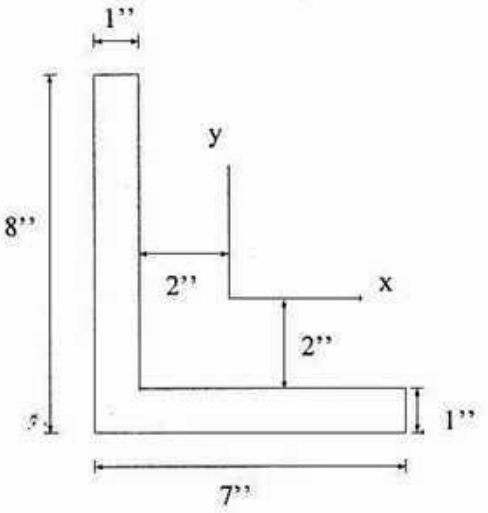
10. Find the co-ordinates of the centroid of the area bounded by $y = x^2/9$ and $x = (3/2)$



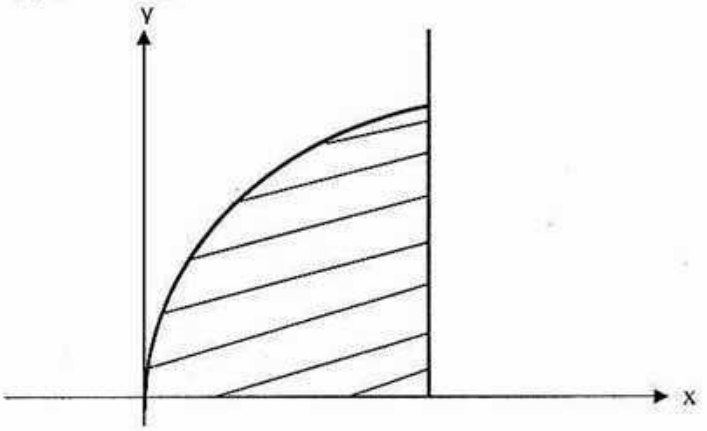
11. Find the centroid of the shaded area.



12. Find the moments of inertia of areas about x-axis and y-axis for the section shown below. Also calculate the product of inertia (P_{xy}) and minimum radius of gyration (k_{min}) about the same axes.



13. Calculate the moments of inertia (I_x and I_y) and product moment of inertia (P_{xy}) of the shaded area, for the given axis system. The shaded area is bounded by parabola $y^2 = 4x$ and the straight line $x = 4$. Apply the integration method.

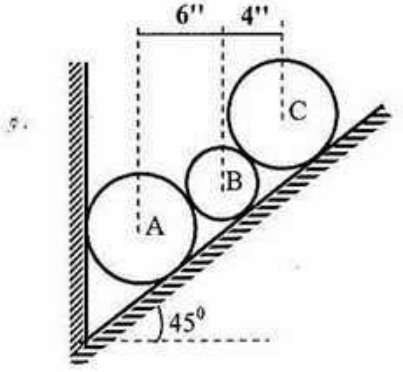


University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
B.Sc. Engineering (Civil)

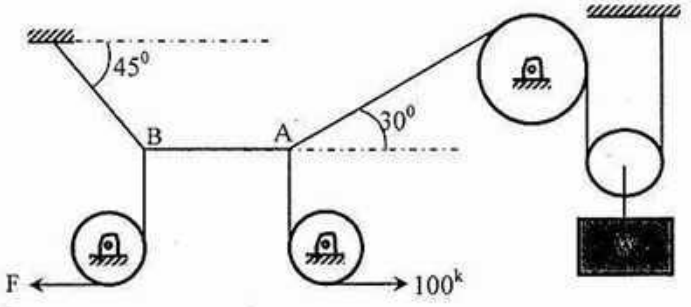
Course Title: Engineering Mechanics I | Course Code: CE 101
Time: 3 hrs | Full Marks: 100 (= 10 × 10)

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

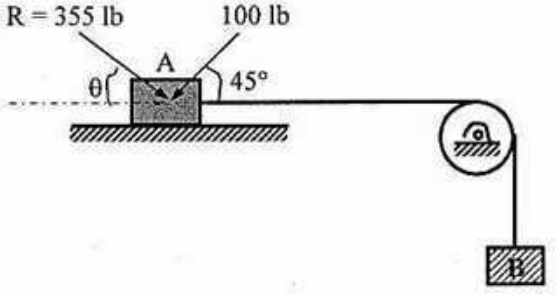
1. In the figure below, the weight of sphere A, B and C is 100 lbs each and diameters of A, C and B is 8", 8" and 5" respectively. Calculate the reactions at the contact surfaces of B and C with the inclined plane.



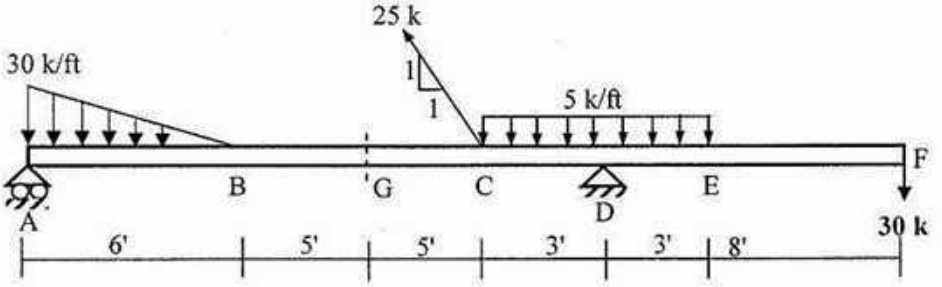
2. In the figure below, find W and F so that the cable AB remains horizontal.



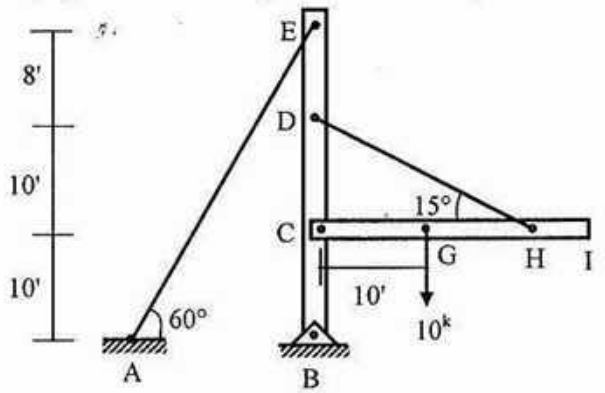
3. In the following force system weight of box **A** is 200 lb and normal force is 50 lb. Calculate the weight of the box **B** and the angle **θ**.



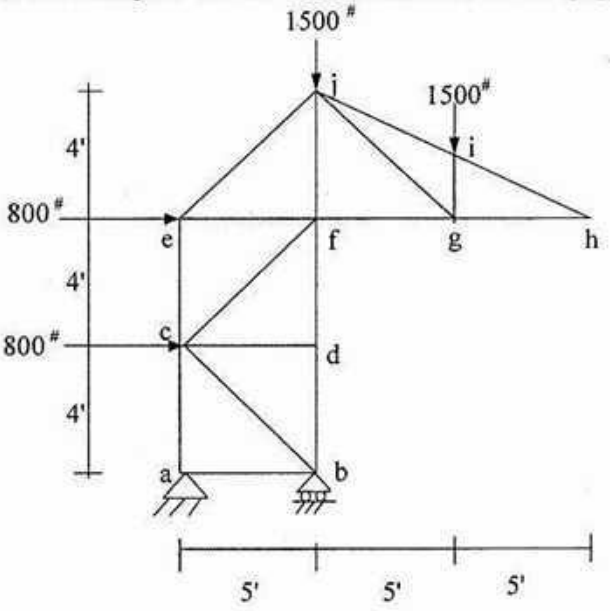
4. Determine the support reactions at **A** and **D** of the beam shown in the figure below. Also calculate the axial force, shear force and bending moment at point **C**.



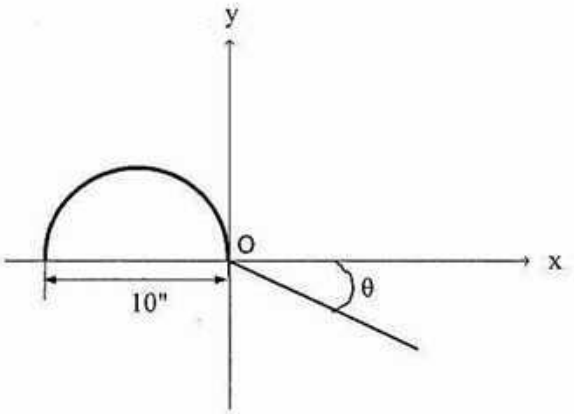
5. Calculate the force in cables AE and DH in the structure shown below. Also calculate the support reaction at B (Neglect the self-weight of the members).



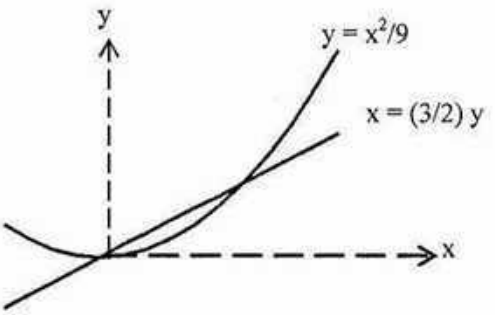
6. For the truss shown in figure, find the force in members cd, cf, ej, gj, ig and ac.



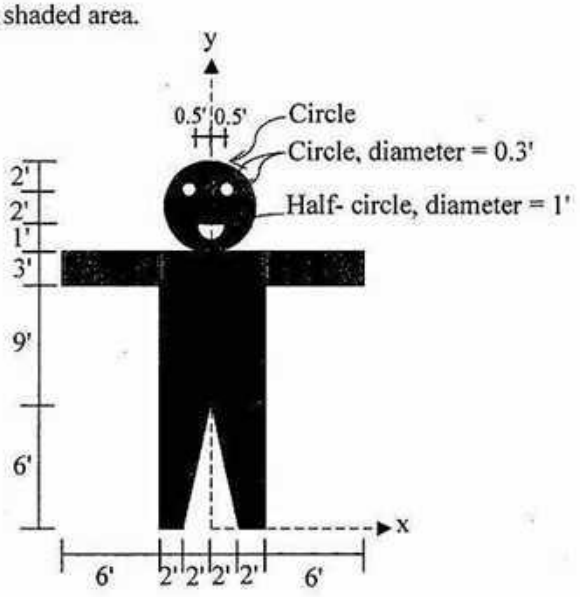
7. Determine the values of l (the length of the straight line) and the angle θ. Given that, the centroid of the composite lines is at the point O, connecting the half circle and the straight line.



8. Find the co-ordinates of the centroid of the area bounded by $y = x^2/9$ and $x = (3/2)\,y$. Apply the integration method.

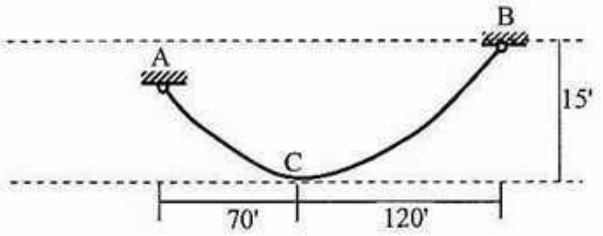


9. Find the centroid of the shaded area.

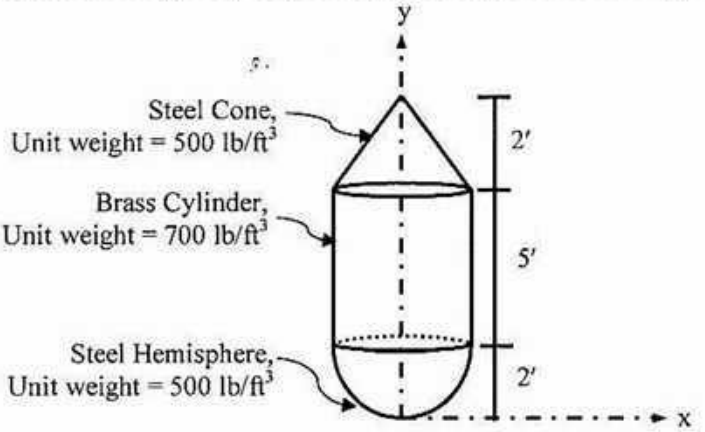


10. A cable weighing 2.5 lb/ft is suspended between two points on the same elevation with a span of 300 ft and sag of 30 ft. Calculate the length of the cable, tension at the lowest point and the tension at the support reaction assuming the cable to be catenary.

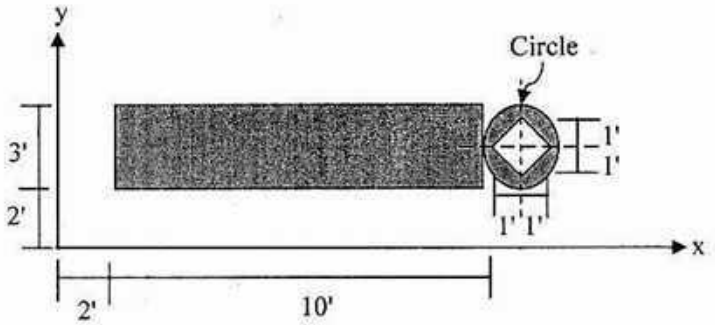
11. The figure below shows cable ACB which is subjected to a horizontal uniformly distributed load and maximum tension at support **A** is 100 lb. Calculate vertical difference between the two supports, uniformly distributed load and horizontal tension in the cable.



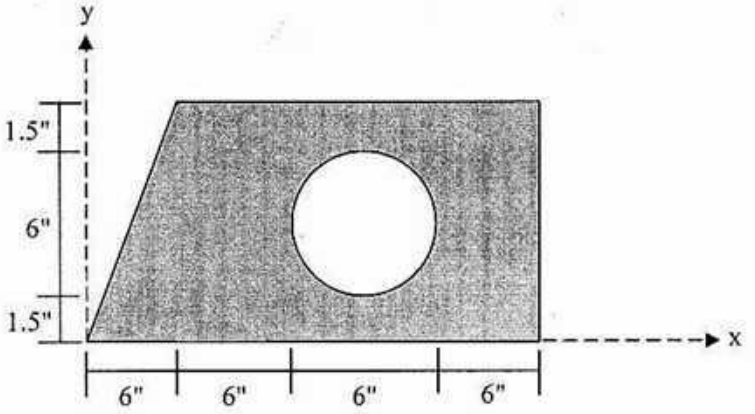
12. Locate the center of gravity of the composite body shown in the figure below.



13. Find the moments of inertia of areas about x-axis and y-axis for the section shown in figure below.



14. The centroid of the shaded area is $\bar{x}$ =13.15", $\bar{y}$ = 4.25", while the centroidal moments of inertia are $\bar{I}_x$ = 19413.42 in^4, $\bar{I}_y$ = 7082.56 in^4. Calculate the minimum moment of inertia of the shaded area and show the corresponding principal axes.

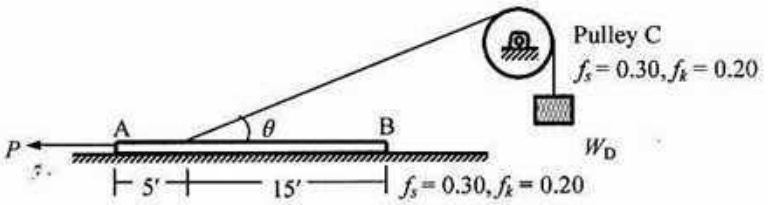


University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011 (Set A)
Program: B. Sc. Engineering (Civil)

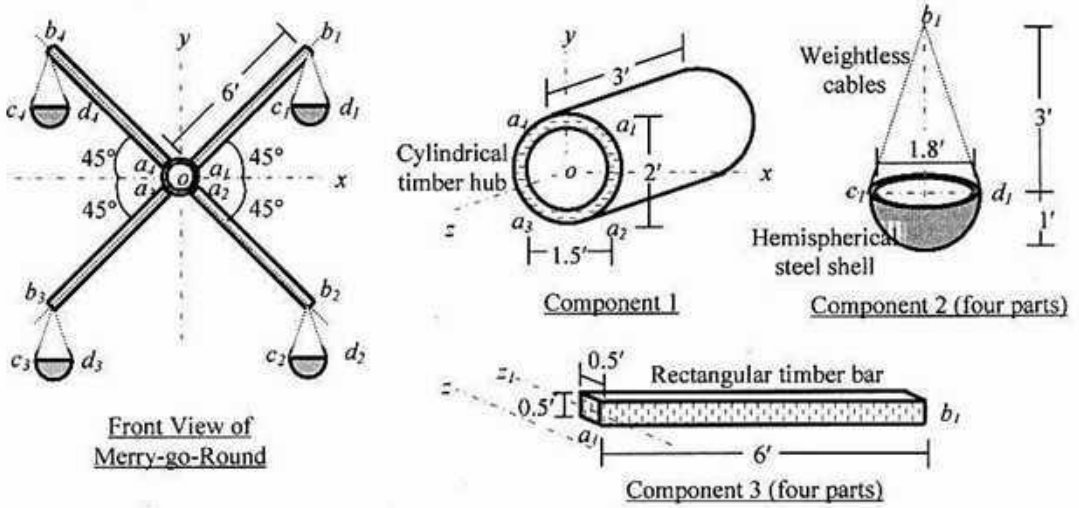
Course Title: Engineering Mechanics II | Credit Hours: 3.0 | Course Code: CE 103
Time: 3 hours | Full Marks: 100 (= 10 × 10)

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

1. The figure below shows a uniform rod AB (weighing W_{AB} = 10 lb) being lifted from a floor by a cable using a weight W_D over the pulley C. If the force $P = 0$, calculate the
   (i) minimum weight W_D required for this purpose
   (ii) required tension in the cable, the angle θ, and the normal force at B
   [Given: Coefficients of friction, $f_s = 0.30$, $f_k = 0.20$ for the pulley as well as the floor].



2. The figure below shows a merry-go-round rotating about its geometric axis (i.e., z-axis), as well as the three components it is made of. Calculate its mass moment of inertia about z-axis
   [Given: Unit weight of timber = 50 lb/ft^3, Unit weight of steel = 490 lb/ft^3].

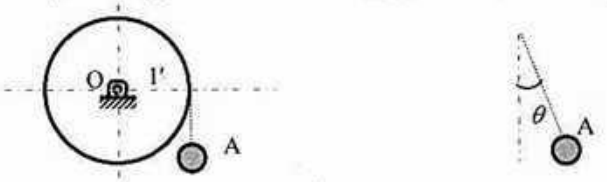


3. The time-dependent displacement $u(t)$ of a body is represented by the following equation

$$u(t) = e^{-0.25t}\,[C_1\,Cos\,(5t) + C_2\,Sin\,(5t)]$$

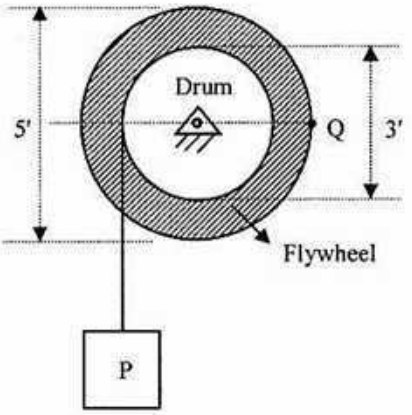
   If the initial displacement of the body is 1 ft and its initial velocity is 5 ft/sec, determine the
   (i) constants C_1 and C_2, (ii) velocity and displacement after $t = 2$ seconds.

4. The 10 lb body A is suspended from a weightless cable at the periphery of a rotating pulley of radius r = 1 ft. Calculate the tension T in the cable and angle θ it makes with vertical, if the pulley rotates with angular velocity of 100 rpm that (i) remains constant, (ii) increases to 200 rpm in 2 revolutions.



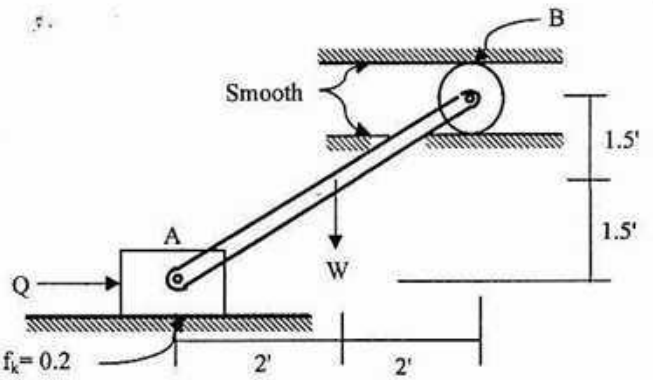
5. If the force P = 10 lb and weight W_D = 10 lb in the system shown in Question 1, calculate the
   (i) cable tension T, (ii) angle θ
   if the bar AB moves leftward along the floor at an acceleration 10 ft/sec^2.

6. A body P is suspended from a cable wound around a 3′ drum and is moving down with an initial velocity of 15 fps and acceleration of 5 fps^2.
   (a) After 10 sec, determine the angular and linear velocities of point Q, which is on the flywheel that turns with the drum.
   (b) Also determine the normal and tangential acceleration of point Q.

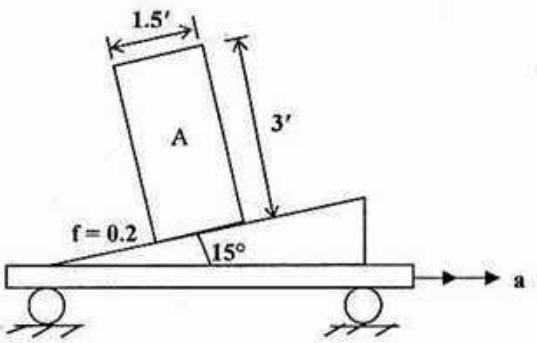


7. Given, W = 100 lb
   R_B = 10 lb (↑)

   Calculate
   (a) Acceleration of the bar (ā)
   (b) Applied force (Q).



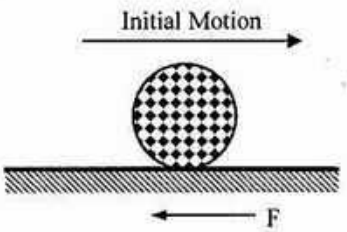
8. A homogeneous body A, weighing 300 lb, is loaded on a truck on an inclined surface as shown in the following figure.



   (a) Will the body tip over or slide if the acceleration (a) of the truck is gradually increased?
   (b) What is the maximum acceleration of the truck, if the body A is to maintain its equilibrium position on the inclined surface?

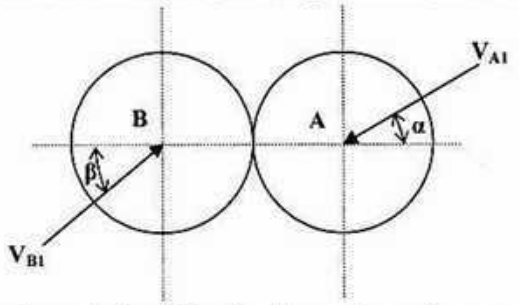
9. After being kicked by a player, the football shown below was moving rightwards with a velocity v_1 = 10 fps. There is a constant resistance to the motion of F = 40 lb.

   What will be its velocity after 20 sec?



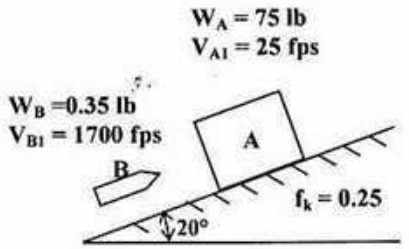
$Weight_{football}$ = 1 lb
$Radius_{football}$ = 3"

10. Two smooth spheres **A** and **B** of equal diameter and on a horizontal plane collide with oblique central impact, as shown in the following figure. Each sphere weighs 8 lb. Coefficient of restitution is 0.75. What are the absolute velocities (including directions) of each sphere after impact?

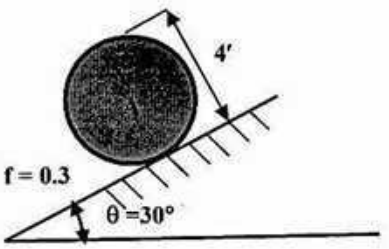


V_{A1} =30 fps
V_{B1} = 20 fps
α = 30°
β = 40°

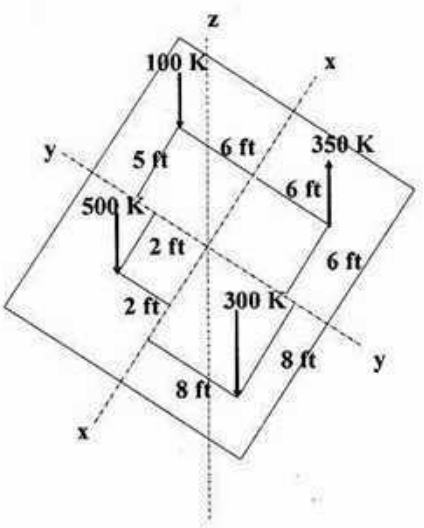
11. A block **A**, as shown in the following figure, is moving up an incline and it is struck by a projectile **B** moving parallel to and upward along the incline. The projectile embeds itself in the block. Calculate
    (a) The total time duration **A** moves after the impact
    (b) The distance traveled by **A** after the impact
    (c) Loss of kinetic energy at the impact.



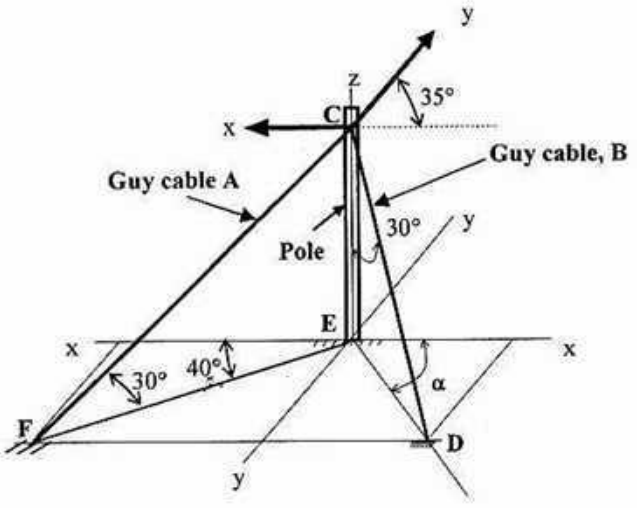
12. In the following figure, a 4 ft cylinder **A**, weighing 450 lb, rolls down a 30° incline from rest. What is the speed of the cylinder after it has rolled 30 ft?



13. All forces in the following figure are in z direction. Determine the magnitude and location of the resultant force.



14. Two cables **A** and **B** terminate on a pole as shown in the following figure and exert forces in the horizontal x-y plane at **C**. The guy cable **CD** makes an angle of 30° with the pole and the anchor at **D** is to be so located that the pole will have only a compressive load. Let **A** = 5000 lb, **B** = 8000 lb and **CE** = 25′. Total compressive load acting on the pole is 10000 lb. Calculate
(a) the value of angle α
(b) the tension in the cable **CD** and **CF**.

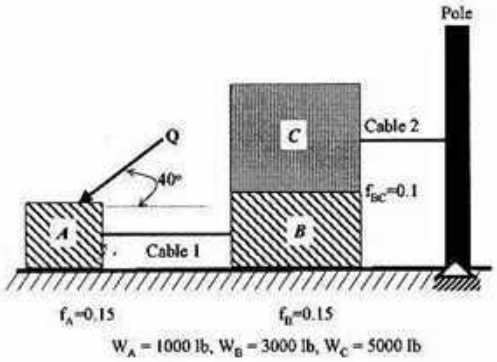


University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011 (Set B)
Program: B. Sc. Engineering (Civil)

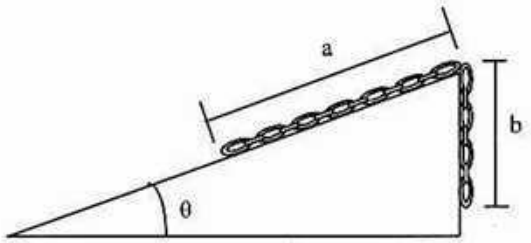
Course Title: Engineering Mechanics II | Credit Hours: 3.0 | Course Code: CE 103
Time: 3 hours | Full Marks: 100 (= 10 × 10)

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

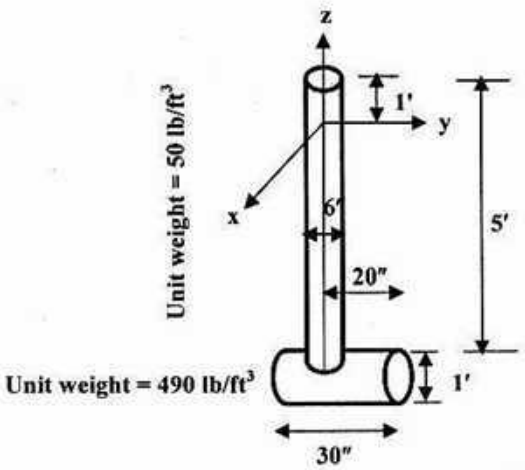
1. Refer to the following figure. Determine the magnitude of force Q that will cause impending motion towards left.



2. If the coefficient of static friction between the chain and the inclined plane is $\mu_s = \tan\theta$, determine the overhang length b so that the chain is on the verge of slipping up the plane. The chain weighs w per unit length.

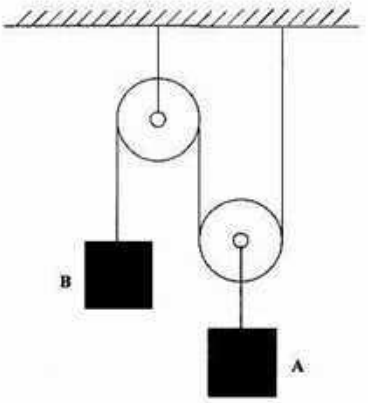


3. Calculate the Moment of Inertia of Mass of the following composite body about x axis.

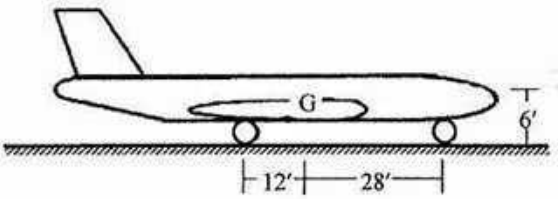


4. A rotating wheel follows the law $\theta = 4t^3 + 3t^2 + 25$ rad, where t is in seconds. Determine the angular displacement, velocity and acceleration after 10 sec. Is the acceleration constant? How many times the wheel will roll in 10 sec?

5. In the following figure, weight of A is 120 lb and weight of B is 80 lb. Consider the cord and pulleys weightless and neglect friction. Determine the acceleration of each body and the tensions in the cords. Also determine the velocity of A and B after B travels 1 ft from rest.

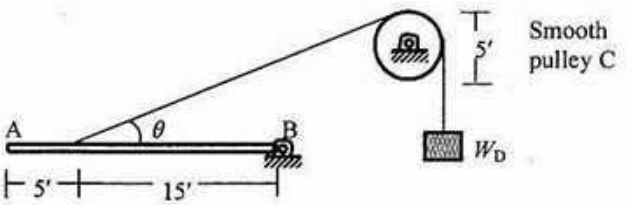


6. In the figure shown below, G is the centroid of an airplane (weighing 50 kips) that starts on the runway from rest and reaches a velocity of 150 mph within a distance of 1000 ft. Calculate the
   (i) normal forces at the front and back wheels of the airplane,
   (ii) corresponding friction forces at the wheels and coefficient of kinetic friction.



7. The figure below shows a uniform rod AB (weighing W_{AB} = 10 lb) being rotated about support B by a cable at an angle $\theta = 30°$ using a weight W_D over the smooth cylindrical pulley C (W_C = 2 lb).

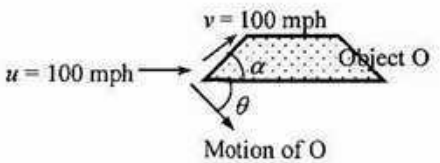
   Calculate the required weight W_D to make its linear acceleration 25 ft/sec^2 (i) downward, (ii) upward.



8. The diameter of a typical cricket ball (assumed spherical) is 3-in and it weighs 0.35 lbs. A fast bowler bowls it at 85 mph, while a spin bowler bowls at 50 mph with a rotational velocity (about its own axis) of 1000 rpm. Calculate the
   (i) energy required (in lb-ft and calories) to bowl each type of ball [Given: 1 Calorie ≅ 3 lb-ft]
   (ii) maximum number of balls a fast and spin bowler should ideally bowl each day
   [Given: Daily energy intake of a bowler = 4000 calories, 50% of which may be used for bowling].

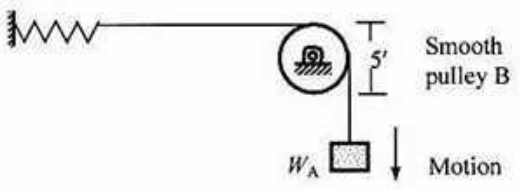
9. The figure below shows wind flowing towards an object O with a velocity of u = 150 mph and over it with the same velocity (i.e., v = 150 mph).

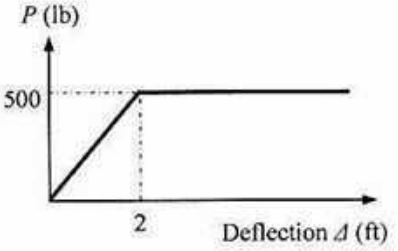
   Calculate the angle α and the magnitude of the resultant wind pressure on the object if the wind moves it in a direction indicated by $\theta = 45°$ [Given: Unit weight of wind = 0.07 lb/ft^3].



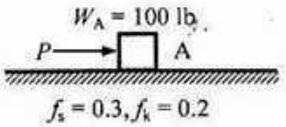
10. The figure below shows a spring being pulled by a weight $W_A = 100$ lb around a smooth cylindrical pulley B (weighing $W_B = 2$ lb). The load-deflection (P-Δ) curve of the spring is also shown.

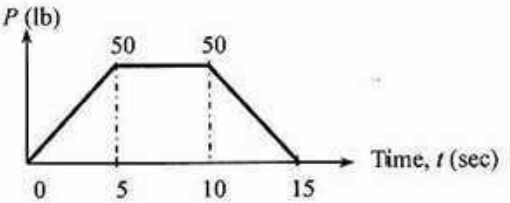
Calculate the velocity of weight A and angular velocity of pulley B if the spring is pulled $\Delta = 3$ ft.



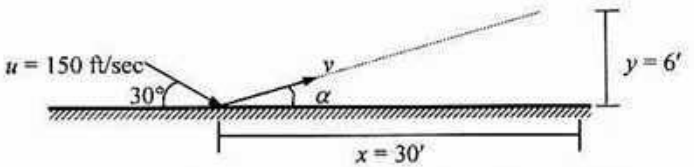


11. The body A is subjected to a force P, whose variation with time is shown below.
(i) If the body starts from rest, when will it start moving (i.e., when will P overcome friction)?
(ii) Calculate its velocity when $t = 15$ seconds.
(iii) When will the body come to rest again?
[Given: Coefficients of friction, $f_s = 0.30, f_k = 0.20$].

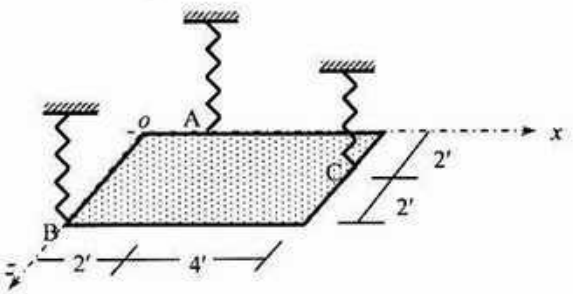




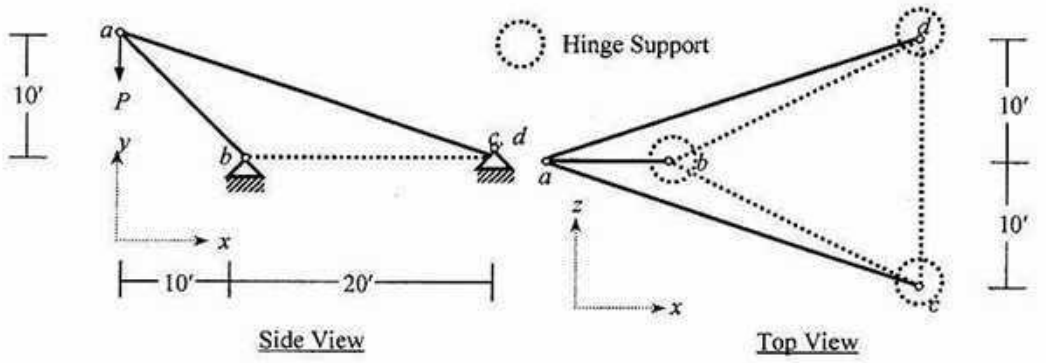
12. A cricket ball hits a ground surface with a velocity of $u = 150$ ft/sec at an angle 30° with the horizontal, and rebound to reach a height $y = 6$ ft, traveling a distance $x = 30$ ft after impact. Assume the ball's trajectory to be approximately straight and calculate the
(i) angle (α) of the ball and time (t) required by it to reach the height y after impact,
(ii) velocity v of the ball after impact and coefficient of restitution (e) between the ball and surface.



13. Figure below shows a uniform rectangular plate (weighing 100 lb) supported by three springs at A, B and C. If coordinates (x, z) of points A, B and C are (2′, 0), (0, 4′) and (6′, 2′) respectively, calculate
(i) the forces in the springs,
(ii) required stiffnesses (k_A, k_B, k_C) of the springs in order to keep the plate horizontal, deflected 1″ from initial position.



14. (i) Determine the member forces *ab*, *ac*, *ad* (in terms of *P*) of the truss loaded as shown below.
(ii) Calculate the allowable force *P* in order to keep all the member forces below 10 kips.



University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B.Sc Engineering (Civil)

Course Title: Surveying | Course Code: CE 105
Time: 3 hrs | Full Marks: 200

Answer ANY 4 out of 5 questions:

1. (a) Draw the basic diagram of 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. 20

(b) Assume that I = 8°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. 24

(c) List the equipment that you will be bringing with you to perform the task mentioned in (b). 6

2. (a) A base line was measured in catenary as shown below, with a tape of nominal length 30 m. The tape measured 30.015 m when standardized in catenary at 20° 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. 28

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 ° 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.

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) A vertical photograph was exposed with a 6-in. focal length camera at a flying height of 10,000 ft above datum. i.) What is the photo scale at point a if the elevation of point A on the ground is 2500 ft above datum? ii.) For this photo, if the average terrain is 4000 ft above datum, what is the average photo scale? 12

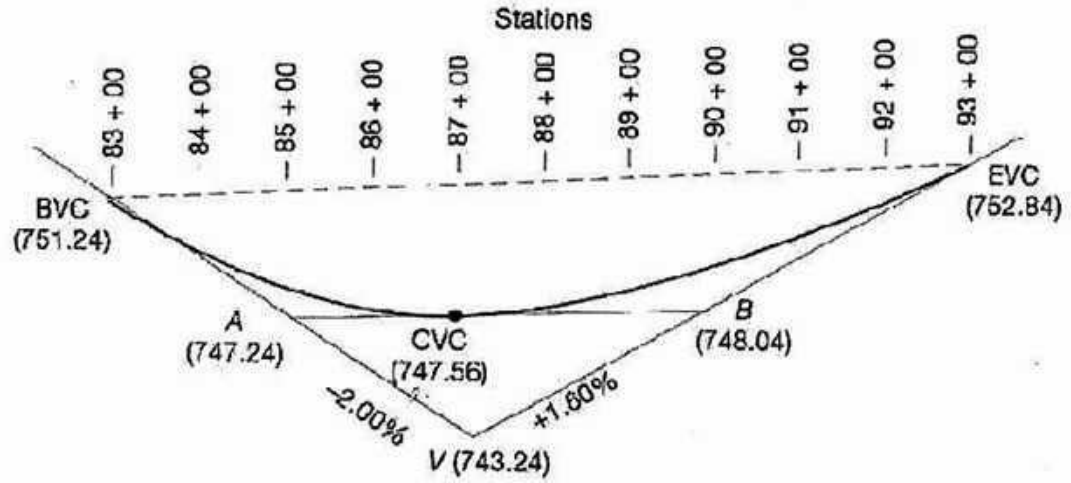
(c) Write a short note on GPS. 10

3. (a) Formulate an example and demonstrate how to check the error of a tilting level. 20

(b) Derive the formula for curvature and refraction error in leveling. 12

(c) Explain mathematically how the position of an unknown ground point is obtained by GPS machines. 18

4. (a) For the configuration of figure below, compute and tabulate the notes necessary to stake the unequal-tangent vertical curve at full stations. 30



(b) What is flattening of an ellipsoid and how do you calculate it? What is geoid? Explain its relationship with earth surface and ellipsoid diagrammatically. 10

(c) What are the uses of aerial photography? Write the specific features of aerial photography and satellite images. Name the six basic imagery attributes. 10

5. (a) Compute the volume using the prismoidal formula and the average area methods for the following 3-level sections of a roadbed having a base of 24 ft and side slope of 1.5 : 1. 24

Station	*L*	*C*	*R*
12+00	C7.8 23.7	C5.3 0	C7.4 23.0
12+50	C6.5 21.8	C6.0 0	C7.5 23.2
13+00	C5.8 24.8	C6.6 0	C7.0 23.5

(b) The radial distance r_b to the image of the base of the pole is 75.23 mm and radial distance r_c to the image of its top is 76.45 mm. The flying height H is 400 ft above datum, and the elevation of B is 450 ft. What is the height of the pole? 10

(c) Coordinates of 5 ground points are as follows: (12.00, 591.78), (125.72, 847.71), (716.29, 694.02), (517.44, 202.94) and (523.41, 51.33). Compute the area enclosed by them. 16

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B.Sc. Engineering (Civil)

Course Title: Surveying | Course Code: CE 105
Time : 3 Hours | Full Marks: 150

There are **EIGHT** questions. Answer any **SIX.**

1. (a) Explain how the procedure of reciprocal leveling eliminates the effects of atmospheric refraction and earth's curvature. (7)
   (b) Define (i) Bench Mark (ii) Datum (iii) Elevation (iv) Turning Point (4)
   (c) The following consecutive readings were taken with a level (14)
   6.21, 4.92, 6.12, 8.42, 9.81, 6.63, 7.91, 10.21,9.22,7.32,6.45
   The level was shifted after 4^{th}, 6^{th} and 9^{th} readings. The reduced level at first point was 100 ft. Calculate the reduced levels of the points by using Height of Instrument Method and apply usual arithmetic check.

2. (a) What is contour? What are the characteristics of contour? (2+5)
   (b) Define (i) Check Line (ii) Tie Line (iii) Main Station (6)
   (c) An instrument was setup at P and the angle of elevation to a flag 1 m above the foot of the staff held at Q was 7^0 30'. The horizontal distance between P and Q was known to be 4000 m. Determine the reduced level of the staff station at Q. Given that the R.L of the instrument axis was 2650.38 m. (12)

3. (a) Explain the "closing error" of a compass survey. Show how you can adjust it by Graphical Method. (2+6)
   (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? (5)
   (c) An excavation is to be made for a reservoir 20 m long and 12 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. (12)

4. (a) What are the instruments used in chain surveying? (3)
   (b) How is a chain survey executed in the field? (8)
   (c) A series of offsets were taken from a chain line to a curved boundary line at intervals of 15 meters in the following (14)
   0, 2.65, 3.80, 3.70, 4.65, 3.60, 4.95, 5.85 m
   Compute the area between the chain line, the curved boundary and the end offsets by
   i)Trapezoidal Rule ii) Simpson's Rule

5. (a) What is meant by shift of a curve? Derive an expression for the same. (2+6)
   (b) Define (i) Compound curve (ii) Transition curve (2)
   (c) Two tangents intersect at chainage 85+75, the deflection angle being 68° 25'. 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) 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 curve. 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)

(b) Define (i) Terrestrial Photogrammetry (ii) Aerial Photogrammetry (4)

(c) Three points A, B and C were photographed and their co-ordinates with respect to the lines joining the collimation marks on the photograph are given in the table below. The focal length of the lens is 100 mm. Determine the azimuths of the line OB and OC, if that of OA is 354° 25′.The axis of the camera was level at the time of the exposure at the station O. (9)

Point	X	Y
a	-45.52 mm	+ 21.43 mm
b	+ 9.48 mm	-16.38 mm
c	+ 48.26 mm	+ 36.67 mm

7. (a) Define (i) Tilted Photograph (ii) Exposure Station (iii) Flying Height (6)

(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 15.5 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%. (9)

(c) 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? (10)

8. (a) Define (i) Ecliptic (ii) Celestial Sphere (iii) First point of Aries (6)

(b) Briefly describe the different zones of earth. (7)

(c) 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. (12)

Given formula:

1. $T = R\tan\frac{\Delta}{2}$, $l = \frac{\pi R\Delta}{180^\circ}$, $\delta = 1718.9\frac{c}{R}$

2. $O_1 = \frac{c^2}{2R}$, $O_2 = \frac{C}{2R}(c+C)$, $O_3 = \ldots\ldots = O_{n-1} = \frac{C^2}{R}$, $O_n = \frac{c'}{2R}(C+c')$

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 Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Introduction to Civil and Environmental Engineering. Course Code: CE 107
Time- 2 hour Full marks: 100

FOR SECTION-A

PART-A

Answer any three questions out of four :

1. Briefly discuss the important urban environmental issues in Bangladesh. Define renewable and non-renewable energy with examples. (10)

2. Define global warming. "The trapping heat in the atmosphere is somewhat analogous to a greenhouse" – explain. (10)

3. a. Explain stationary sources of air pollution with examples. (5)

   b. Define ecosystem and what are its components? (5)

4. What is acid rain? Show in a schematic diagram how photochemical and sulfurous smog develops? (10)

PART- B

Answers any two questions out of three :
(Note: Question no. two is compulsory)

1. a. Give the names in details of the following codes with their related fields: (5)

   I. ACI II. BNBC (1993) III. AREA IV. AASHTO V. ASTM

   b. Mention the various steps to be followed by the engineering firm to construct a hospital at Dhaka city. (2.5)

   c. Mr. Rahim purchased a plot of 15m wide (front side) and 20m long. He wants to construct a five storied residential (Type A2) building on his plot. For RAJUK approval what will be the minimum requirements as per building byelaws of following items ? (10)
   (I) Habitable Rooms (air condition must be provided)(II) Kitchen (III) Bathroom

2. a. Define the following terms: (5)
I. Load bearing walls & non-load bearing walls II. Plinth area
III. Deep foundation IV. Dead load.

b. Vertical extension for one storey of a building will be done on 8 nos R.C.C circular column. Diameter of each column is 12 inch and 10 feet height. A beamless slab thickness is 6 inch and area is 400 sqft. 5 inch brick work need for partition wall and total area will be 600 sqft. How much material cost for this construction as per current market price ? (12.5)

3. a. Define project surveying. Write the steps to complete the project surveying of an irrigation project. (12.5)

b. How can you ensure satisfactory quality of cement in the field ? (5)

PART-C

Answers any one out of two:

1. a. What is FAR ? (3)

b. What does the term 'contract' mean ? Mention different types of contract. (12)

c. Discuss on the occupancy type of a building as classified by RAJUK. (8)

d. What will be the minimum front set back as per RAJUK rules for a 60 m wide and 80 m long plot ? (12)
Consider the width of the adjacent road as follows:
(i) 3m wide road (ii) 12 m wide road

2. a. Briefly discuss the problems in the development of transportation system in Bangladesh. (12)

b. How should an engineer acts in professional matters, according to IEB Code of Ethics for Engineers ? (11)

c. Define the following terms: (12)

(i) Mezzanine floor (ii) Height of the building (iii) Road width

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Introduction to Civil and Environmental Engineering. Course Code: CE 107
Time- 2 hour Full marks: 100

FOR SECTION-B

PART-A

Answer any six.
(Question No. 1 is compulsory and answers any five from the rest)

1. Describe the following (any five): (5X4)

   a. Values knowledge and social justice as an environmental issue.

   b. Sustainability and the urban world as environmental issues.

   c. Age Structure.

   d. Meteorological and hydrological drought.

   e. Possible effect of sea level rise in Bangladesh.

   f. Biodiversity.

   g. Important impacts due food surplus during agricultural societies.

2. a. Derive the equation of doubling time as a function of growth rate. (5)

   b. When the present population of Dhaka city (20 million) will be double with a growth rate of 1.8%. If population follows exponential growth ? Use both continuous compounding and doubling time equation. (5)

3. Briefly discuss the important urban environmental issues in Bangladesh. Define renewable and non-renewable energy with examples. (10)

4. Define global warming. Show in a schematic diagram how photochemical and sulfurous smog develops ? (10)

5. a. . Explain stationary sources of air pollution with examples. (5)

   b. Define ecosystem and what are its components ? (5)

6. Describe different uses and issues of water. (10)

7. Define water pollution? Write any four different categories of water pollutant along with their sources and impact. (2+8)

8. Assume that a population follows a simple logistic growth curve. In 1970 world's population was 4 billion and its growth rate was 1.6%. If present growth is 2.5% find the carrying capacity, maximum sustainable yield and corresponding time (t*) also find population size in 2012. (10)

PART-B

Answers any one out of two:

1. a. Give the names in details of the following codes with their related fields: (5)

   I. ACI II. BNBC (1993) III. AREA IV. AASHTO V. ASTM

   b. Mr. Rahim purchased a plot 15m wide (front side) and 20m long. He wants to construct a five storied residential (Type A2) building on his plot. For RAJUK approval what will be the minimum requirements as per building byelaws of following items ? (10)
   (I) Habitable Rooms (air condition must be provided) (II) Kitchen (III) Bathroom (IV) Garage

2. a. How can you ensure satisfactory quality of cement in the field ? (2.5)

   b. Vertical extension for one storey of a building will be done on 8 nos R.C.C circular column. Diameter of each column is 12 inch and 10 feet height. A beamless slab thickness is 6 inch and area is 400 sq.ft. 5 inch brick work need for partition wall and total area will be 600 sq.ft. How much material cost for this construction as per current market price ? (12.5)

PART-C

Answers any one out of two :

1. a. What is FAR ? (3)

   b. What will be the minimum front set back as per RAJUK rules for a 60 m wide and 80 m long plot ? Consider the width of the adjacent road as follows: (12)

   (i) 3m wide road (ii) 12 m wide road

2. a. Briefly discuss the problems in the development of transportation system in Bangladesh. (12)

   b. How do you calculate the road width ? (3)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
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 a commercial building project based on the following data: (40)

Volume ratio of sand to total aggregate = 0.38
Air Content = 2 % (air-entraining admixture is not used)
Specific gravity of cement = 3.1 (OPC)
Specific gravity of sand (SSD) = 2.66
Specific gravity of coarse aggregate (SSD) = 2.70
Design compressive strength (28 days) = 4500 psi
Minimum required slump = 175 mm
Maximum aggregate size = ¾ inch, Aggregate type = Stone chips
Dosage of superplasticizer = 5 ml/kg of cement if W/C is less than 0.45.
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 concrete mix,
(ii) Calculate the unit weight of the proposed mix,
(iii) Prepare a mixture proportion table of the proposed 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 1350 kg/m^3, 1300 kg/m^3 and 1400 kg/m^3, respectively,
(vi) Calculate unit cost of concrete. Assume the cost of 1 bag cement is Tk. 450, cost of 1 cft sand is Tk. 30, and cost of 1 cft stone chips is Tk. 130,
(vii) Estimate the materials in weight and volume (cement, water, sand, and coarse aggregate) required to make 10 beams of 12 inch width 20 inch depth and 18 ft span each,
(viii) Assume 4% surplus water in sand over SSD condition and the amount of bulking of sand is 20%. Make proper adjustment of the proposed mix,
(ix) Explain the influence of s/a ratio on compressive strength and workability of concrete, and
(x) Explain the effect of cement content on the compressive strength of concrete.

2 For a bridge construction project, the recommended FM 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
5/8 inch	0	1950
3/8 inch	0	100
#4	0	2100
#8	80	800
#12	105	0
#16	5	0
#30	5	0
#40	5	0
#50	5	0
#100	50	0
#200	45	0
Pan	50	50

Answer the following:

(i) Calculate FM of the samples,
(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) Discuss the effect of grading and FM of coarse and fine aggregates on the compressive strength of concrete.

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

22 3 (a) Draw typical stress-strain curves of steel from low grade to high grade. Explain the possible changes in mechanical properties of steel with the change of grades. (2.5)

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

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

(i) Malleability,
(ii) Creep coefficient, and
(iii) Resilience.

(d) "Concrete is a commonly used construction material" – Give some reasons to justify. (3)

(e) Explain how bricks get strength during burning. (3)

(f) Discuss the field tests of bricks. (3)

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

(h) You have tested a brick sample in the lab. Water absorption capacity is found to be 25%, also the brick shows deposit on the surface after drying. Make comments on the quality of the brick. (3)

4 (a) Draw a flow diagram of manufacturing of cement. What will happen if gypsum is added with very hot clinker? (4)

(b) What is hydration of cement? Write the hydration reactions of cement and discuss the morphology of the hydration product. (5)

(c) Compare fly ash cement and OPC cement 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) "Cement industries are polluting the global environment"- What measures are necessary to reduce pollution from cement industries? (3)

(f) Discuss the influence of free lime in cement. (2)

5 (a) Discuss seawater attack (chloride, sulfate and carbon-dioxide) of concrete with chemical reactions. (7)

(b) What measures are to be taken to make durable concrete structures in seawater? (5)

(c) Define workability of concrete. How is it measured? Discuss the effect of the following factors on workability of concrete: (5)

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

(d) "W/C ratio is a key parameter related to strength and durability of concrete" – explain briefly. (3)

(e) What is the purpose of using air entraining admixture in concrete? Compare entrained air and entrapped air in concrete. (2)

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

(i) W/C,
(ii) Temperature ,
(iii) Grading of 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 followings: (6)
   (i) High strength concrete,
   (ii) Porous concrete,
   (iii) Maturity of concrete,
   (iv) Casting of concrete in hot weather,
   (v) Chemical admixtures, and
   (vi) Mineral admixtures.

(d) Write short notes on the following: (5)
   (i) Cold joint,
   (ii) Construction joint,
   (iii) Laitance,
   (iv) Segregation, and
   (v) Plastic shrinkage. .

(e) What is autogeneous shrinkage? How does it differ from plastic shrinkage? (2)

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

7 (a) What is passivation film? How is it broken? (3)

(b) Discuss corrosion of steel in concrete with chemical reactions. (5)

(c) Discuss the possible ways to delay initiation of corrosion of steel in concrete due to carbonation and chloride. (3)

(d) What kind of cement is to be used for the following purposes: (4)
   i) To reduce sulfate attack of concrete,
   ii) To get high early strength, and
   iii) To reduce heat of hydration,

(e) "Fly ash shows pozzonanic activity but slag shows hydraulic activity" – Why? (4)

(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 different forms of grading curve of aggregate. (2)

(b) Explain three industrial forms and three market forms of timber. (4)

(c) How are annual rings formed in a tree? (2)

(d) Write short notes on the following: (9)
   (i) Use of plastic in Civil Engineering works,
   (ii) Atomic packing factor for body centered cubic unit cell,
   (iii) Ingredients of varnish,
   (iv) Electroplating,
   (v) Vulcanization, and
   (vi) Ferrocement.

(e) Discuss the characteristics of good quality aggregates. (2)

(f) Draw stress-strain curves for the following materials and explain their behavior: (3)
   i) Rubber,
   ii) Copper, and
   iii) Concrete.

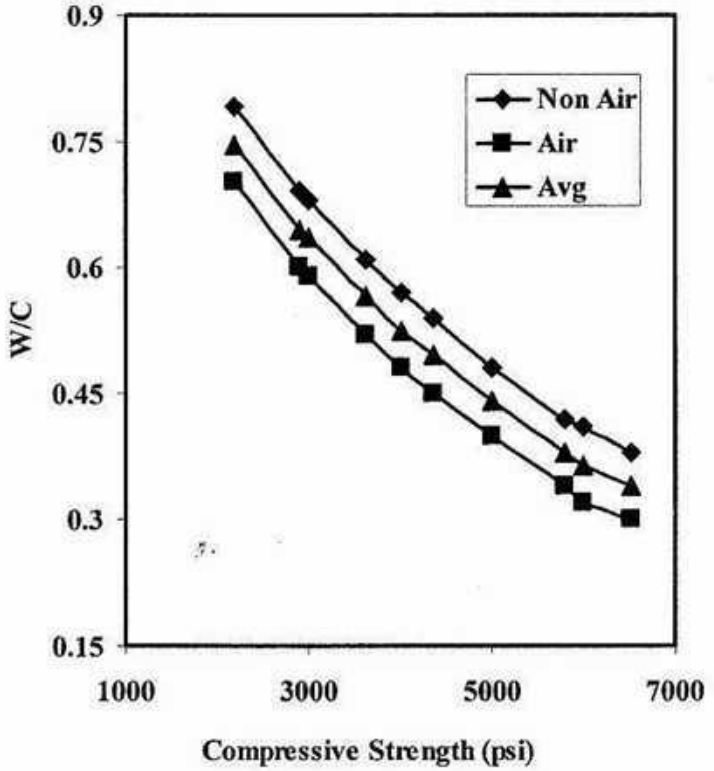


Fig. W/C versus Compressive Strength (aggregate type = stone chips)

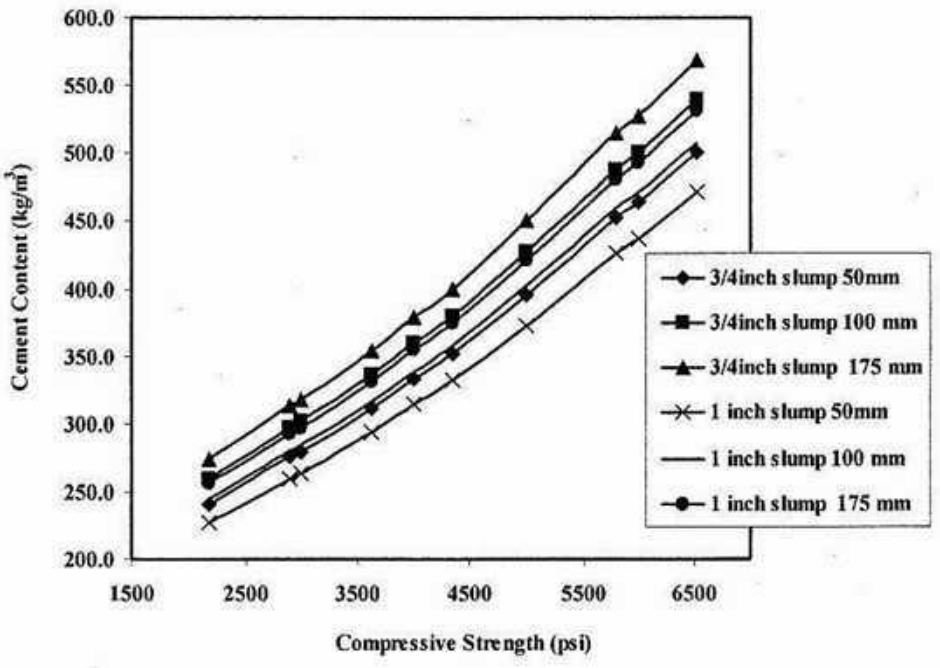


Fig. Cement Content versus Compressive Strength (aggregate type = stone chips)

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

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title : Engineering Geology & Geomorphology — Course # : CE 203
Time: 3 hours — Full Marks: 120 (6 X 20 = 120)

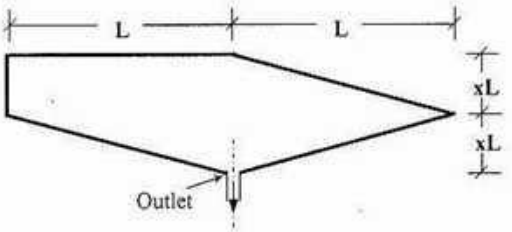
Section A

There are **four (4)** questions in this section, answer **any three (3)**

1. (a) Draw a schematic diagram of the rock cycle and discuss (with at least two examples of each) about igneous, sedimentary and metamorphic rocks according to the cycle. 14

   (b) Describe, in brief, the principal zones of the earth from geologic point of view. 6

2. (a) In the following basin x is a constant factor? For what value of x, the flow rate (Q) or runoff will be the maximum? Also Find the FF and CC of the basin for maximum runoff. 8



   (b) Derive relationship between compactness co-efficient (CC) and form-factor (FF). 3

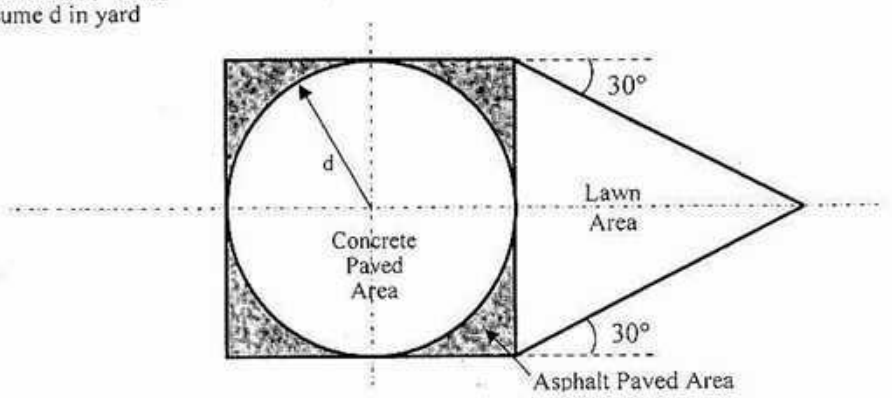
   (c) Draw neat sketch of different routs/ways of runoff (Total Flow). 4.5

   (d) Define halide minerals, precipitation and infiltration. 4.5

3. (a) Discuss, in brief, the chemical weathering processes. 5

   (b) Discuss, in brief, the factors affecting runoff. 8

   (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



4. Briefly discuss, mention or draw sketches, as asked for, on **any four** of the following topics:- 5 X 4 = 20

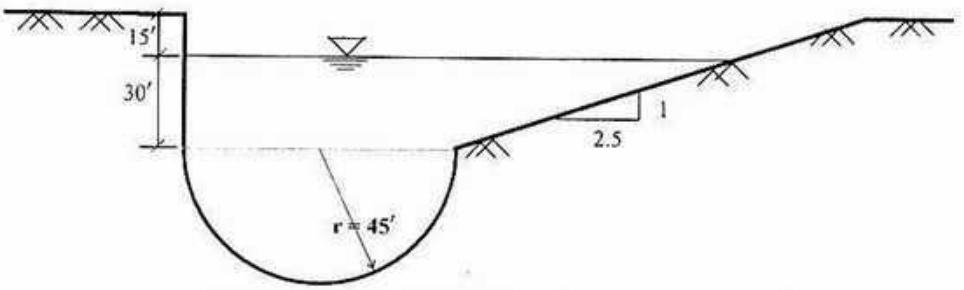
(i) Write down the common properties of mineral.
(ii) Neat sketches of Horst and Graben.
(iii) Classify (mention names only) folds (based on geometry) and also draw neat sketches of Homocline and Syncline.
(iv) Define Rational method, hydrogaph and time of concentration.
(v) Fault classification according to net slip.

Section B

There are **four (4)** questions in this section, answer **any three (3)**

5. (a) What are the major causes of river erosion? 1.5
(b) Prove that $d \propto v^2$; where symbols carry their usual meanings. 7.5
(c) Prove that $H = ae^{-bx}$; where symbols carry their usual meanings. 4
(d) The longitudinal and cross-sectional profiles of a channel are shown below. Calculate the tractive pressure along the channel. 7

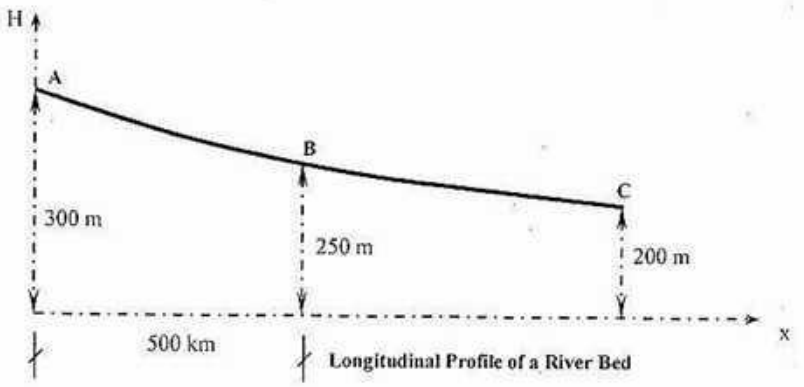
(Longitudinal Profile of Channel Course)



(X-Sectional Profile of Channel Course)

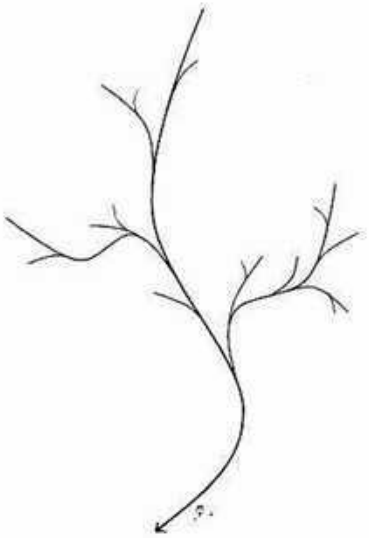
6. (a) What is drainage pattern? Classify drainage pattern(mention names only). Write short notes of basin pattern and ring like pattern with neat sketch. 7
(b) Draw x-section of a typical river valley. Write down the classification of river valley. Also write short notes of any three on each basis. 5
(c) Classify (mention names only) mineral with two examples of each. Distinguish between Ferromagnesian and non-Ferromagnesian silicates. 8

7. (a) Define river transportation, load, capacity and competence. Write short notes on various types of loads of a river. 5
(b) Using the figure shown below, calculate the horizontal distance between A and C. 4



Longitudinal Profile of a River Bed

(c) Rank the streams of the following drainage basin having a total catchment area of 8,999 square kilometer. The results of the survey are summarized in the table below. 9



Steam Rank	Average Length (km)
1	7.0
2	18.9
3	44.8
4	99.9

Calculate the following parameters:
(i) Average Bifurcation Ratio (ABR)
(ii) Average Length Ratio (ALR)
(iii) Stream Frequency

(d) Write down the laws of stream order/rank. 2

8. (a) Define earthquake. Mention the causes of earthquake. Define the major earthquake parameters (geometric) with neat sketches. 8

(b) Discuss liquefaction phenomenon (with basic mechanism) due to earthquake. 7

(c) Tabulate Modified Mercalli intensity scales of earthquake (V to IX). 5

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
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)

SECTION A (Numerical Analysis)

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

1. Use Modified Euler method to evaluate the numerical solution of the following ordinary differential equation, for x = 3 with step-size equal to 3. (10)

$y' + x^2y^2 = 2$

Here, y = 1 at x = 0 and desired accuracy, $\varepsilon = 0.001$.

2. If f(0) = 1, f(1) = 2.718, f(2) = 7.389 and f(3) = 20.086, determine the value of f(2.5) using Lagrangian and Gregory-Newton Interpolation Polynomial. (10)

3. Derive a best-fit equation of the form $S = 5(1-m*e^{-nt})$ [i.e., $\log_e(1-S/5) = \log_e m - nt$] for the data shown in Table below and calculate S for t = 10 days using the best-fit equation. (10)

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

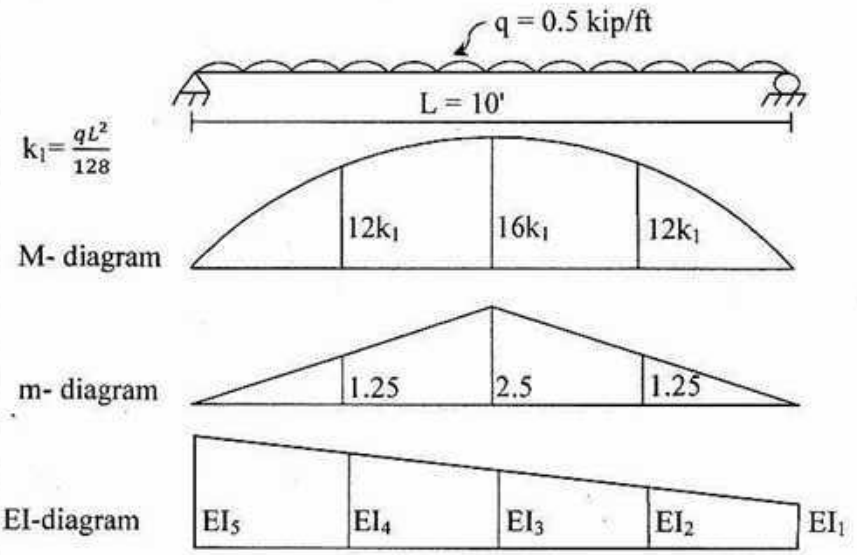
4. For the following data, (10)

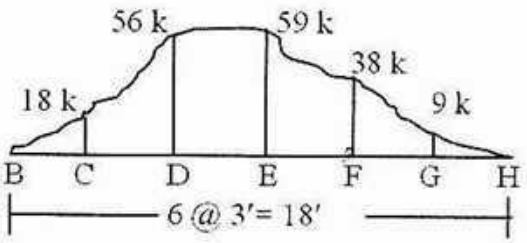
Time (sec)	30	45	60	75
Speed (mps)	0.249	0.561	1.584	3.235

(i) Find the Gregory Newton Interpolation polynomial.
(ii) Find the speed at times, t = 55 sec and t = 70 sec.

5. Use Simpson's ⅓ rule to find the deflection, δ (in terms of EI_1) of the beam shown, (10)

$\delta = \int_0^L \frac{Mm}{EI}\,dx$ and $EI_5 : EI_1 = 5 : 1$



6.	Fit a parabola [$y = f(x) = a_0 + a_1 x^2$] using the (x,y) ordinates of five points (0,1.2) ; (0.9,3.5) ; (2.1,7.1) ; (3.2,17.5) ; (3.9,28). Also calculate f(2.5).	(10)
7.	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, $\alpha = 4\times10^{-12}$, $T_a = 250$, $T(1) = 2500$ Solve the ODE for t = 5 by 4th order Runge-Kutta Method using step-size of 2.	(10)
8.	The Shear Force diagram of a beam is shown below. Find the total bending moment produced over the beam. ($M = \int V\,dx$). Use both Simpson's $\frac{1}{3}$ rule and Simpson's $\frac{3}{8}$ rule. 	(10)

SECTION B (Computer Programming)

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

1. Write a program that can read the starting value and number of iterations to solve ***sin(x)*** $= e^{-x}$ using the Iteration Method. (10)
2. Write a program that is able to calculate **(A+B) × C** using three separate Matrices namely **A**, **B** and **C** of same size. (10)
3. Write a program to obtain the greatest and the smallest of n integer numbers and print them on screen. Program should read the value of n. (10)
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. (10)

Formulae:

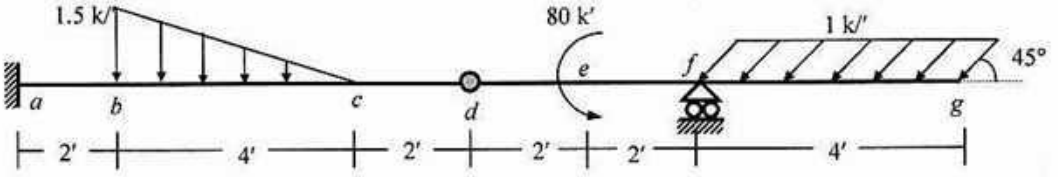
1. $P = (x-x_1)(x-x_2)....(x-x_n)/\{(x_0-x_1)(x_0-x_2)....(x_0-x_n)\}f(x_0) + (x-x_0)(x-x_2).....(x-x_n)/\{(x_1-x_0)(x_1-x_2)....(x_1-x_n)\}f(x_1) + ...+ (x-x_0)(x-x_2)....(x-x_{n-1})/\{(x_n-x_0)(x_n-x_1)....(x_n-x_{n-1})\}f(x_n)$
2. $P = f(x_1) + \{\Delta f(x_1)*u\}/1! + \{\Delta^2 f(x_1)*u*(u-1)\}/2!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

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011 (Set A2)
Program: B. Sc. Engineering (Civil)

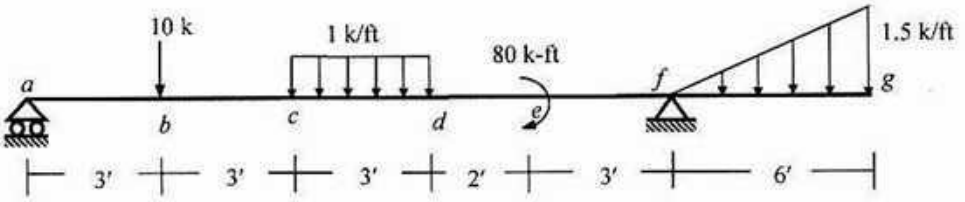
Course Title: Mechanics of Solids I | Credit Hours: 3.0 | Course Code: CE 211
Time: 3 hours | Full Marks: 100 (= 10 × 10)

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

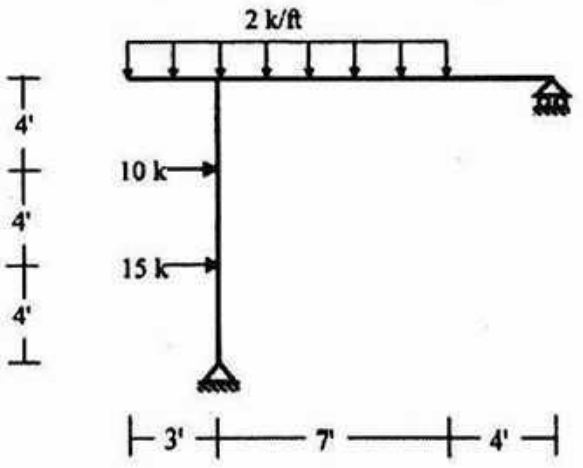
1. Draw the axial force, shear force and bending moment diagram for the beam shown below.



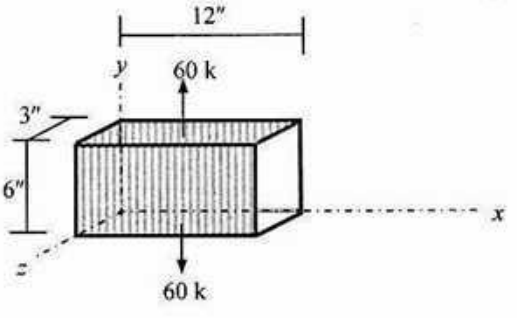
2. For the beam *abcdefg* loaded as shown in the figure below
   (i) Derive the equations for shear force and bending moment using Singularity Functions.
   (ii) Calculate shear force at the left of point *b* and bending moment at the right of point *e*.



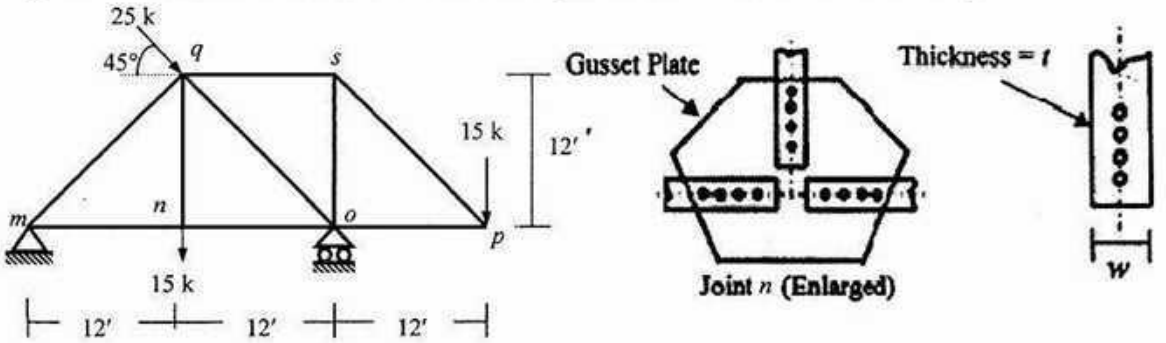
3. Draw the axial force, shear force and bending moment diagram for the frame loaded as shown below.



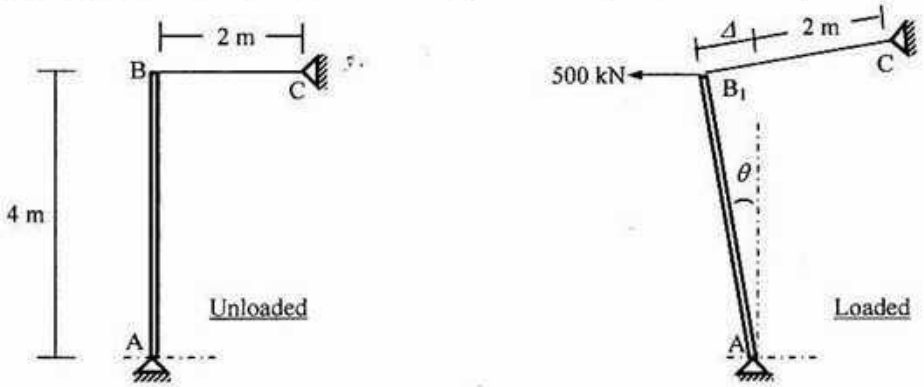
4. The rectangular prism shown below is subjected to normal force in the *y* direction and is restrained in the *x* and *z* directions (i.e., $\varepsilon_{xx} = 0$, $\varepsilon_{zz} = 0$). Calculate the normal stresses (σ_{xx}, σ_{yy}, σ_{zz}) and strain (ε_{yy}) that develop in the prism [Given: Modulus of Elasticity = 3000 ksi, Poisson's ratio = 0.25].



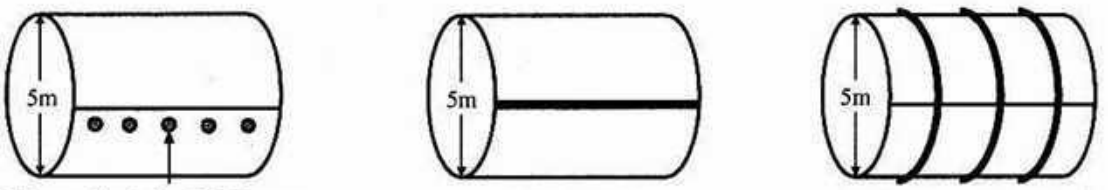
5. For the member *nq* (a rectangular plate) of the truss loaded as shown below, calculate the required (i) bolt diameter(d), (ii) thickness(t) of the member *nq*, (iii) width (w) of the member *nq*
[Given: Allowable shear stress = 15 ksi, bearing stress = 10 ksi, axial stress = 12 ksi].



6. Calculate the elongation Δ, angle θ and force in cable BC (supporting rigid bar AB) in the structure loaded as shown below [Given: E = 70 GPa, A = 20-mm^2, L = 2 m for BC].

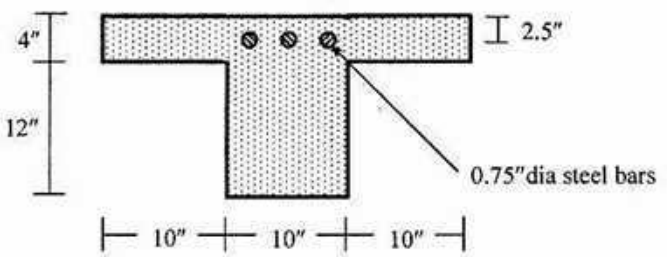


7. The figure below shows three different ways to join the wall of a 5-m diameter gas cylinder. If it requires 20-mm diameter longitudinal bolts to be spaced @ 150 mm c/c, calculate the
(i) allowable internal gas pressure within the cylinder
(ii) required thickness of longitudinal welds to resist the wall stresses
(iii) required diameter of steel hoops spaced @ 250 mm c/c to resist the wall stresses
[Given: Allowable shear stress in bolts = 150 MPa, Allowable tensile stress in the hoops = 200 MPa].

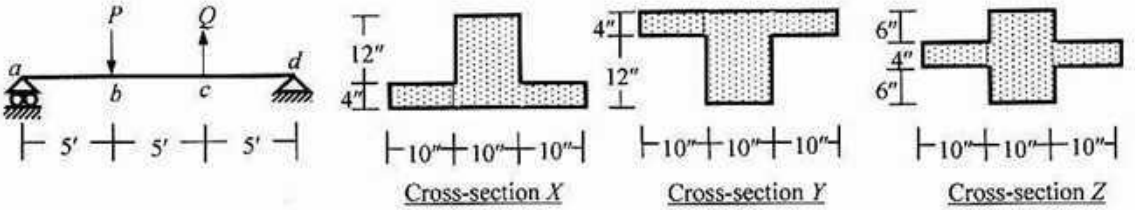


20-mm dia Bolts @ 150 mm | Welded Joint | Steel Hoops @ 250 mm

8. For the Reinforced Concrete section shown below, calculate the maximum allowable
(i) positive 'uncracked' bending moment,
(ii) negative 'cracked' bending moment
[Given: n = 8, allowable compressive stress in concrete = 2.0 ksi, allowable tensile stress in concrete = 0.3 ksi, allowable tensile stress in steel = 24 ksi].



9. For the beam *abcd* loaded as shown below, the allowable tensile and compressive bending stresses in the cross-section are 0.3 ksi and 2.0 ksi respectively. If $Q = 0$, calculate the maximum allowable value of P for sections X, Y and explain their relative suitability for this loading.



Cross-section X Cross-section Y Cross-section Z

10. Calculate the plastic moment (M_p) of sections Y and Z shown in Question 9 and explain their relative suitability for bending [Given: Yield Strength $\sigma_{yp} = 4$ ksi, for both tension and compression].

11. Figure below shows the composite cross-sectional area of beam *abcd* loaded as shown in Question 9. If the allowable tensile and compressive bending stresses for concrete are 0.3 ksi and 2.0 ksi respectively, while they are both equal to 3.0 ksi for timber, calculate the maximum allowable value of the force P ($= Q$) on the beam, considering flexural stresses at both b and c.

Cross-section b and c

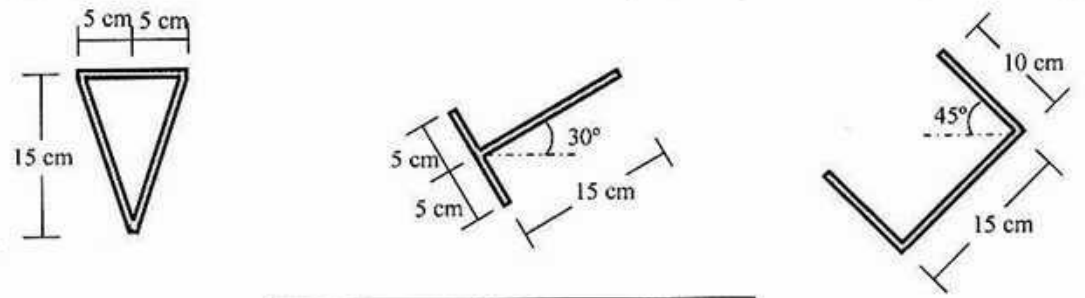
12. For the beam *abcd* shown in Question 9, the allowable flexural shear stress is 120 psi. If $P = 0$, calculate and comment on the maximum allowable value of Q, for the sections X and Z.

13. The figures below show two 10-mm thick plates welded to Section1 to form Section2. Calculate the
(i) allowable shear forces in Section1 and Section2,
(ii) required weld thickness to resist the allowable shear force in Section2
[Given: Allowable shear stress in the sections as well as welds = 150 MPa].

Section1
(All dimensions in mm)

Section2
(All dimensions in mm)

14. Cross-sectional areas of three beams are shown below by their centerline dimensions. Calculate the torsional moments caused on the sections by their respective self-weights (50 kg each).



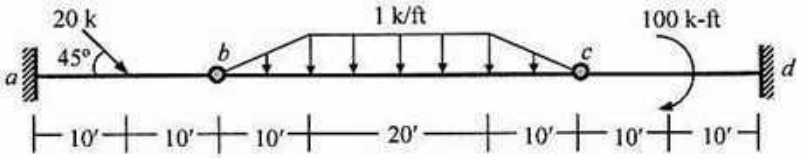
Thickness = 0.3 cm (throughout each section)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011 (Set B2)
Program: B. Sc. Engineering (Civil)

Course Title: Mechanics of Solids I | Credit Hours: 3.0 | Course Code: CE 211
Time: 3 hours | Full Marks: 100 (= 10 × 10)

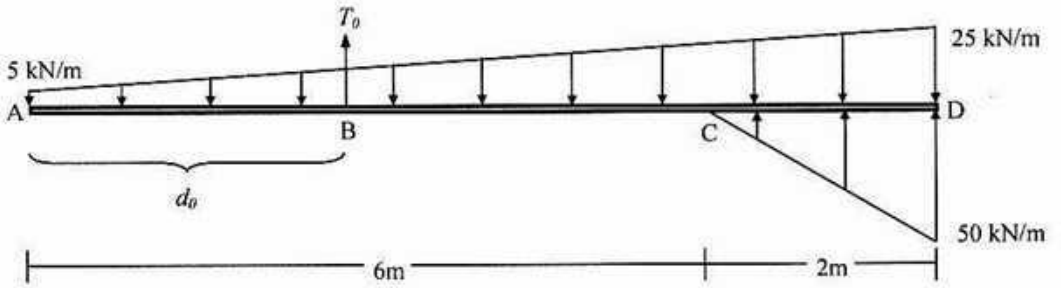
[Answer **any 10 (ten)** of the following 14 questions]

1. Draw the SFD and BMD of the beam *abcd* loaded as shown below.

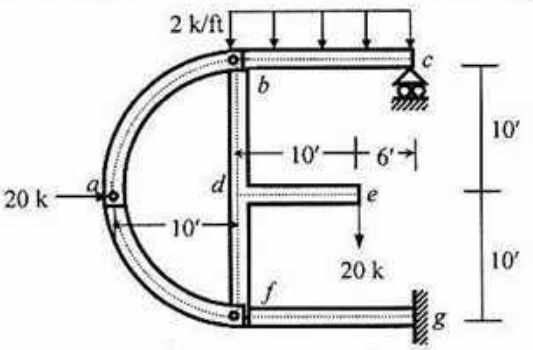


b and *c* are Internal Hinges

2. Beam ABCD shown below represents a sheet pile under the action of soil pressures on both sides and tie-rod force. Use Singularity Functions to calculate the
   (i) length d_0 and concentrated force T_0 required to maintain equilibrium,
   (ii) shear force at the right of B and bending moment at C.

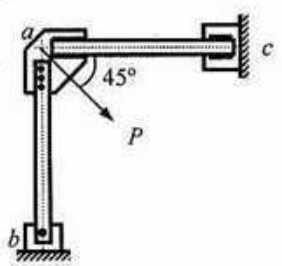


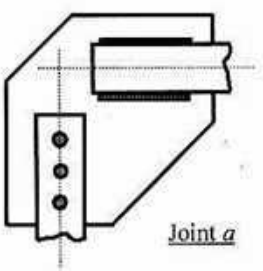
3. Draw the AFD, SFD and BMD of the beams *bc* and *fg* in the frame *abcdefg* loaded as shown below.

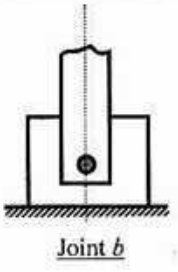


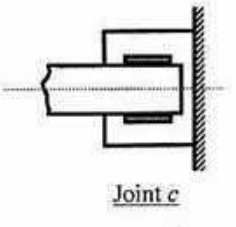
4. (i) Calculate the maximum allowable value of the force P in the truss *abc* loaded as shown below, considering the diameter of bolts at joint *a* to be 10-mm and bolt at joint *b* to be 20-mm, while member *ab* is 100-mm wide and 10-mm thick
   (ii) For the force P calculated in (i), determine the required lengths of 5-mm thick welds at joint *a* and 10-mm thick welds at joint *c*

   [Given: Allowable stress in shearing = 150 MPa, tearing = 250 MPa, bearing = 200 MPa].




Joint *a*

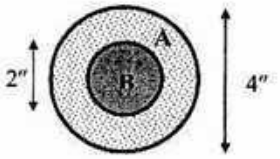

Joint *b*


Joint *c*

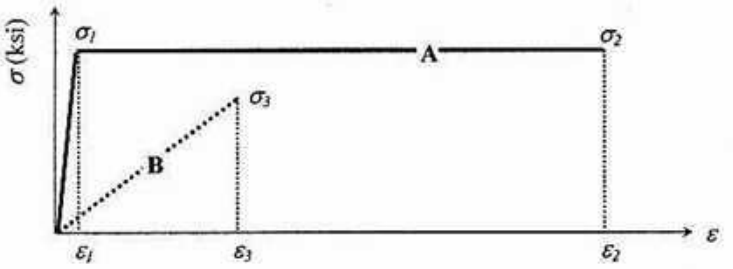
5. The figure below shows the cross-sectional area of a 25″ long composite specimen made of materials A and B whose stress (σ) vs. strain (ε) diagrams are also shown.

If $\sigma_1 = \sigma_2 = 12$ ksi, $\sigma_3 = 10$ ksi, $\varepsilon_1 = 0.003$, $\varepsilon_2 = 0.090$, $\varepsilon_3 = 0.030$, calculate the

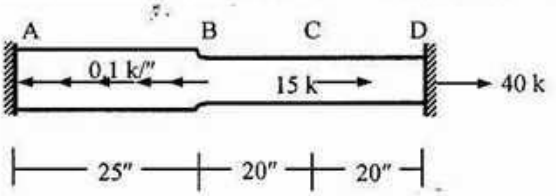
(i) ultimate (maximum) load on the specimen and its corresponding deformation,
(ii) breaking load on the specimen and its corresponding deformation,
(iii) energy required to break the specimen.



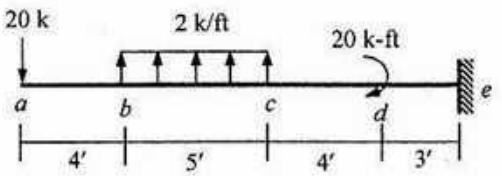
Composite Cross-section

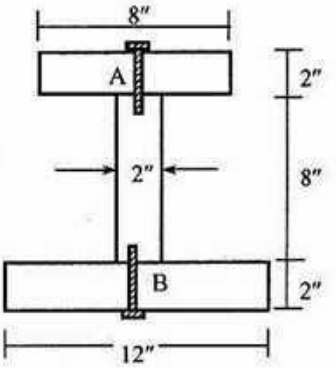


6. Draw the axial force diagram of the statically indeterminate axially loaded bar shown below [Given: E = 2500 ksi, Members AB and BC are (8″ × 3″/8) and (6″ × 3″/8) sections respectively].



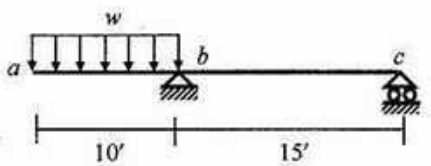
7. Calculate the spacing of 3/8″ bolts (both A and B) to resist the maximum shear force developed in the beam *abcde* loaded as shown below [Given: Allowable shear stress = 10 ksi].

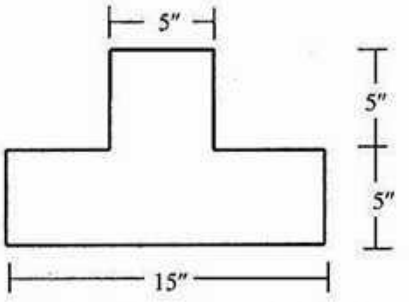




8. Derive the expression, $\sigma_x = -M_z y/I_z$ for pure bending of a beam.

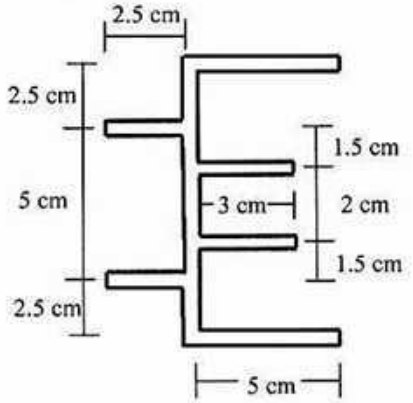
9. For the beam shown below, the allowable tensile and compressive bending stresses in the cross-section are 12 ksi and 8 ksi respectively.
   (i) Calculate the maximum allowable value of the distributed load *w*.
   (ii) Draw the bending stress diagram over cross-section for the value of *w* calculated in (i).





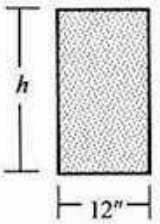
10. For the beam shown in Question No. 9, the allowable flexural shear stress is 90 psi.
    (i) Calculate the maximum allowable value of the distributed load *w*.
    (ii) Draw the shear stress diagram over cross-section for the value of *w* calculated in (i).

11. Determine the location of shear center of the cross-section shown below by centerline dimensions.

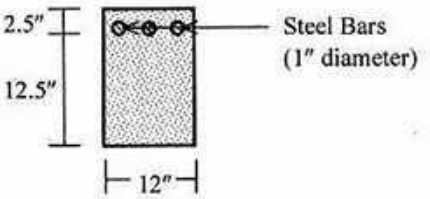


Thickness = 0.10 cm (throughout)

12. (i) Calculate the required depth 'h' if the Section 1 shown below (made of concrete) is subjected to a negative bending moment of 65 k-ft.
    (ii) Calculate the maximum flexural stress in concrete if the section is made of Reinforced Concrete as shown below in Section 2. Assume the section is 'cracked' due to concrete tension
    [Given: Allowable concrete stress in tension = 150 psi, compression = 1350 psi, $n = 10$].

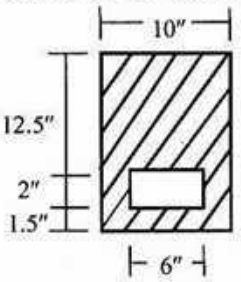


Section 1 (Concrete)



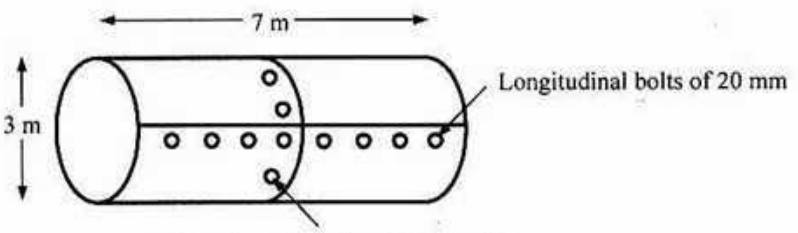
Section 2 (Reinforced Concrete)

13. Calculate the Section Modulus, Plastic Section Modulus and Shape Factor of the section below.



14. For a gas cylinder of 3 m diameter and 8 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 20 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 = 100 MPa, Modulus of elasticity = 20 GPa, Poisson's ratio = 0.30].

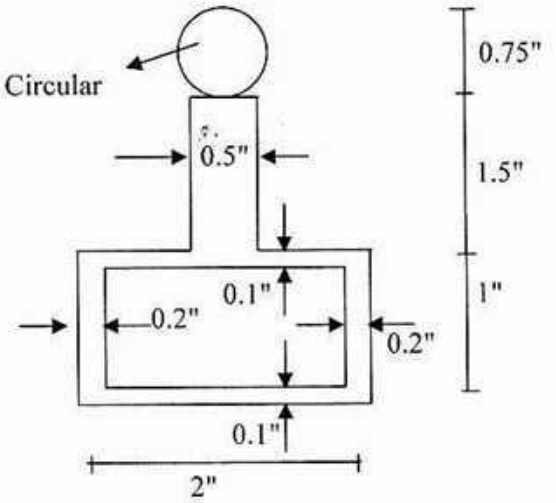


University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B.Sc Engineering (Civil)

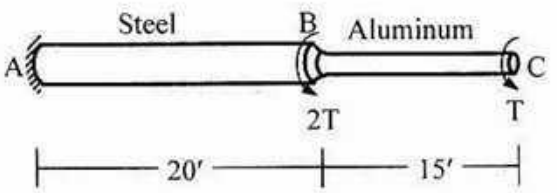
Course Title: Mechanics of Solids II — Course No: CE 213
Time: 3 hours — Full marks: 10x10=100

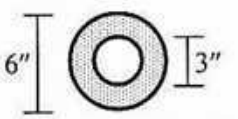
Answer any **10** of the following **14** questions.

1. Calculate the magnitude and location of the maximum shear stress if the compound section shown is subjected to a torque of 15 k-ft [G=12000 ksi].



2. In the figure shown below, calculate the maximum permissible value of T required to meet the following conditions: $\tau_{steel} \leq 12$ ksi, $\tau_{aluminium} \leq 8$ksi and the torsional rotation at C is limited to 6° [Given: $G_{aluminium} = 4000$ ksi, $G_{steel} = 12000$ ksi].

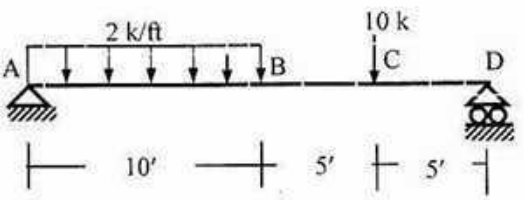




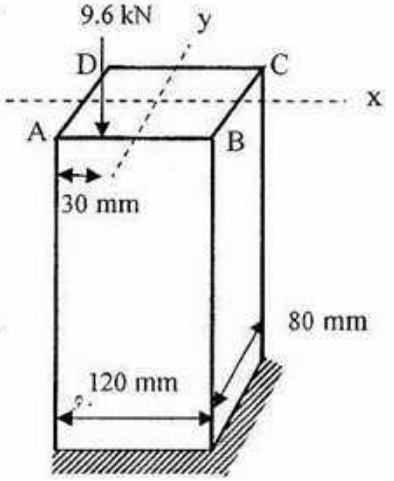
Cross-section of member AB

Cross-section of member BC

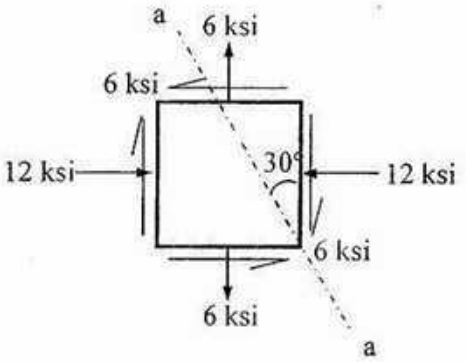
3. For the beam shown below, use singularity functions to calculate the deflection at C and rotations at left of B [EI= 40,000 k-ft^2].



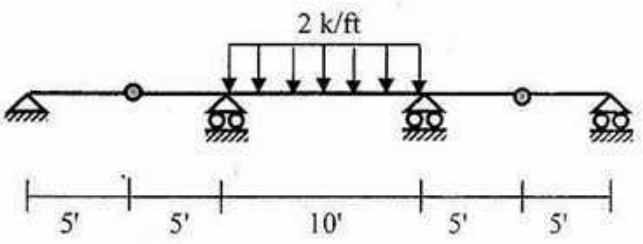
4. Determine the stress at A, B, C and D for the block loaded eccentrically as shown in the figure. Locate the neutral axis. Neglect the weight of the block.

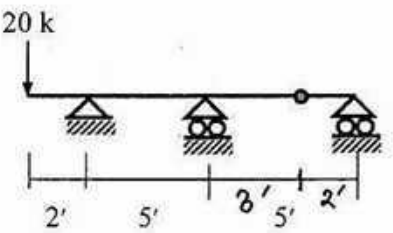


5. Using Mohr's circle of transformation of stress, determine the normal and shear stresses on plane a-a along with the principal stresses and maximum shear stress on the element.

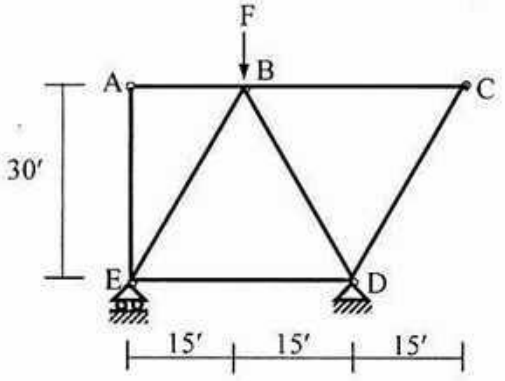


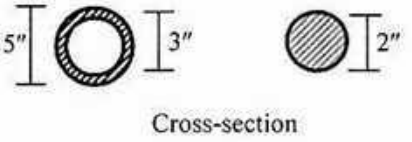
6. For the beams shown below,
   a) Write the expression for loading function w using singularity function
   b) Write down the boundary conditions
   c) Comment on whether the beams are statically determinate or indeterminate
   d) Draw the qualitative deflected shapes.





7. Calculate the allowable value of F for the truss shown below using the AISC-ASD criteria. The vertical member is hollow circular tubes of 5″ outside and 3″ inside diameter and the horizontal and inclined members are solid circular sections of 2″ diameter[Given, E = 29000 ksi, f_y = 40 ksi for all members]

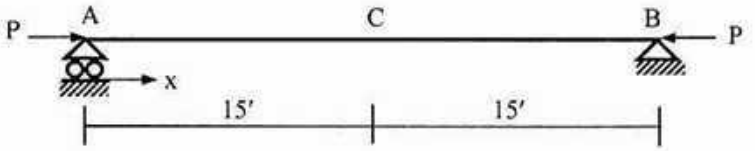




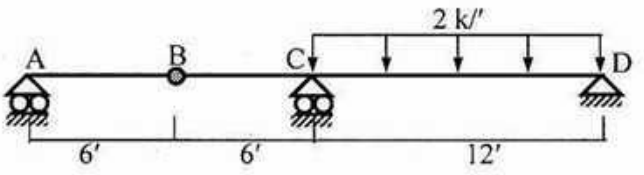
Cross-section

8. Prove the Euler formula for critical load for slender column and state the assumption used for deriving the formula.

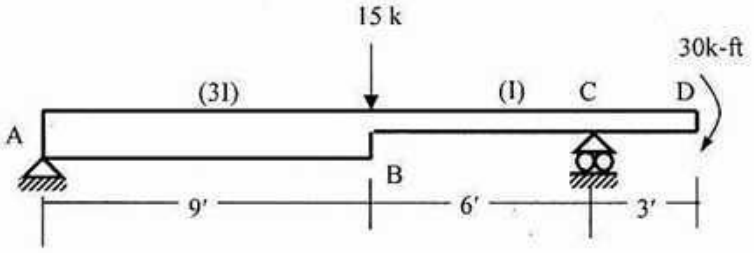
9. The beam ACB shown below has an initial deflected shape of $v_i(x) = v_{0i} \sin(\pi x/L)$. If the deflection at C for P = 100 kips is 1″, calculate the value of v_{0i} and the deflection at C for P = 200 kips [Given: EI = 4×10^6 k-in^2].



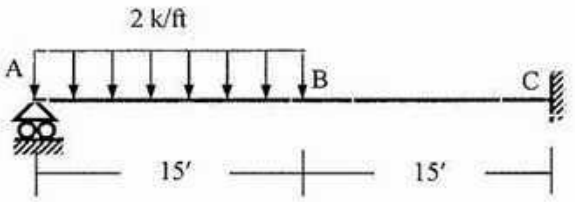
10. For the beam shown below, calculate the deflection at B and rotations at the left and right of B [EI= constant].



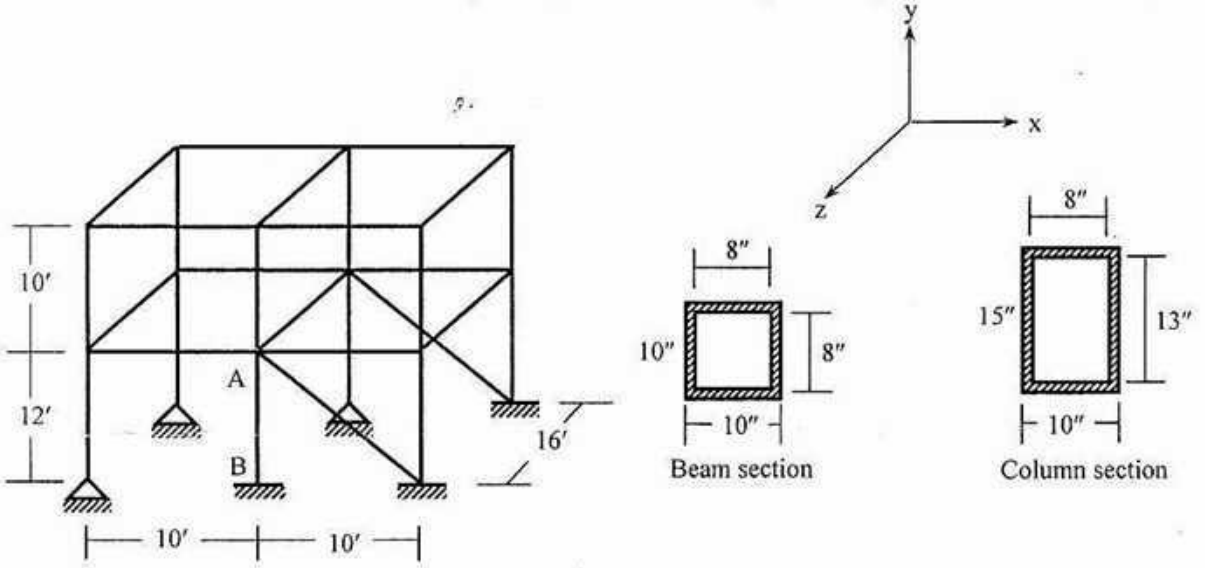
11. For the beam ABC shown below, calculate the deflection at D and rotation at B.



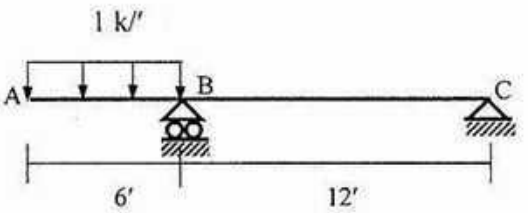
12. Draw the shear force and bending moment diagram of the beam shown below.



13. In the frame shown below, calculate the effective length factor of column AB about x and z-axis. The column is braced for buckling with respect to x axis and unbraced with respect to z axis. Determine the critical load for the column AB [Given, $E = 29\times10^3$ ksi, $f_y = 60$ ksi].



14. For the beam shown below calculate the deflection v_A using the moment-area theorems [EI_{AB} = 40,000 k-ft^2, EI_{BC} = 20,000 k-ft^2].

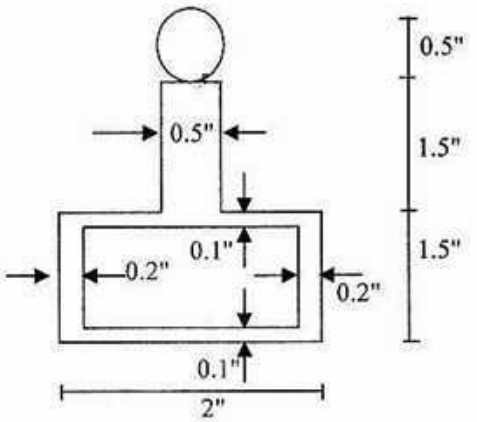


University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B.Sc. Engineering (Civil)

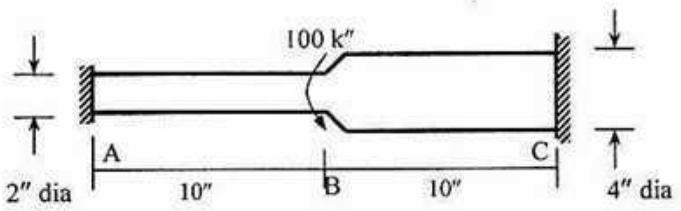
Course Title	: Mechanics of Solids II	Course Code: CE 213
Time	: 3 hours	Full Marks :10x10=100

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

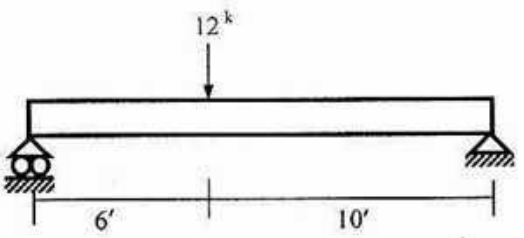
1. Calculate the magnitude and location of the maximum shear stress if the compound section shown is subjected to a torque of 25 k-ft [Given :G=12000 ksi].



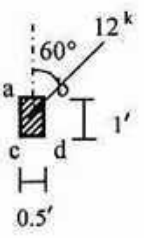
2. Calculate the torsional shear stress at A and the torsional rotation at B for the circular rod (of non-uniform diameter) shown below (Neglect stress concentration) [Given: G = 12000 ksi].



3. Calculate the maximum compound normal stress in the beam shown below (subjected to inclined loading) and show the point/points where it occurs [The beam area is a 0.5′× 1′ rectangle].

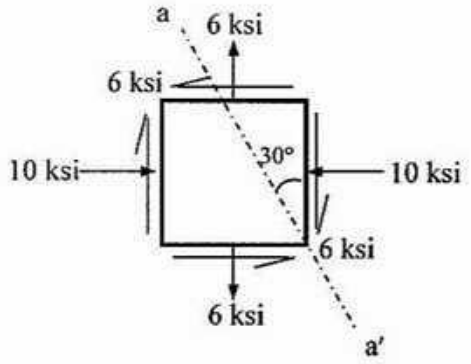


Side Elevation

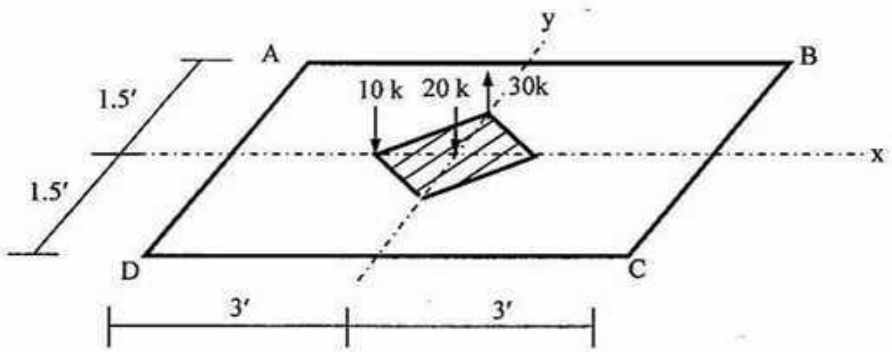


Cross-section

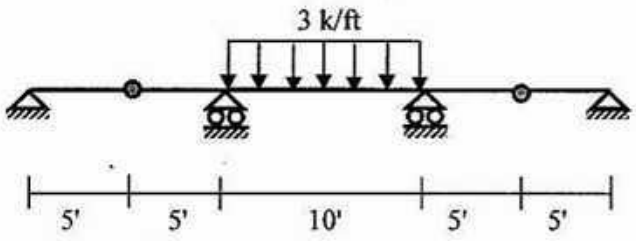
4. Use the Mohr's Circle of stress transformation or stress transformation formula to calculate the normal stress and shear stress on the plane a-a'. Also calculate the magnitude of maximum and minimum normal stress on the element.

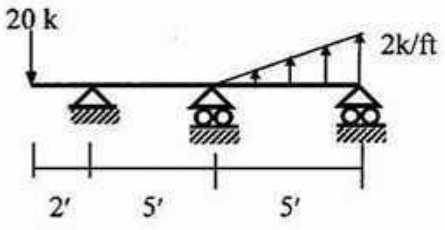


5. The shaded area shown below represents the kern of the rectangular footing ABCD. For the given loads calculate the normal stresses at A, B, C, D.



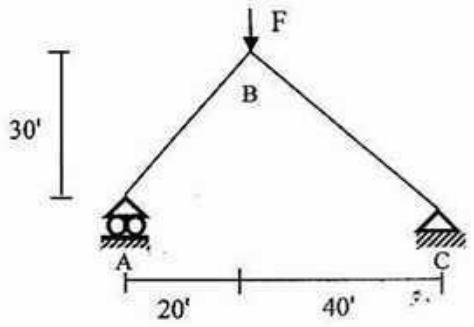
6. For the beams shown below,
   a) Write the expression for loading function w(x) using singularity functions
   b) Write down the boundary conditions
   c) Comment on whether the beams are statically determinate or indeterminate
   d) Draw the qualitative deflected shapes.

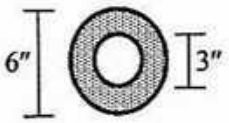




7. Prove the Euler formula of critical load for slender column and state the assumption used for deriving the formula.

8. Determine the maximum allowable load F that can be applied on the pin-connected structure shown below using AISC-ASD design criteria for buckling [Given: yield strength f_y= 60ksi, E=290000ksi].

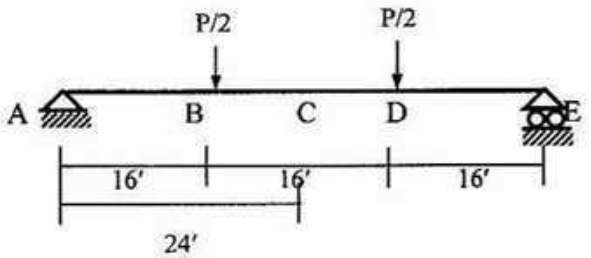




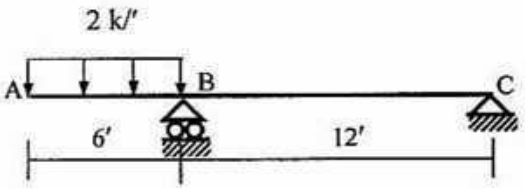
Cross-section of member AB

Cross-section of member BC

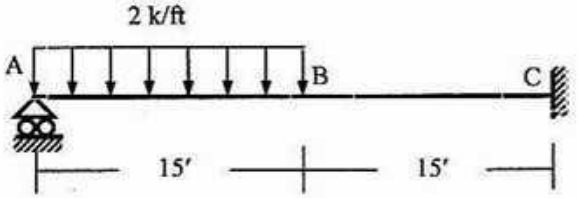
9. Calculate the value of P if the deflection at point C happenes to be 6 inch downward. Use singularity function to solve this problem [Given: EI=40,000k-ft^2].



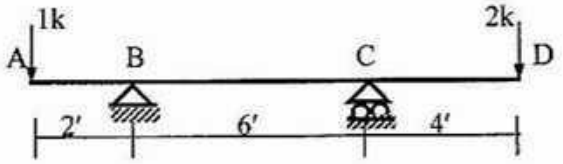
10. For the beam shown below calculate the deflection v_A using the moment-area theorems [Given :EI_{AB} = 40,000 k-ft^2, EI_{BC} = 20,000 k-ft^2].



11. Use the conjugate beam method to calculate deflection at B and rotation at A [Given: EI= 40000k-ft^2].

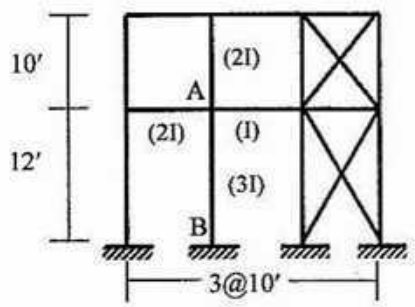


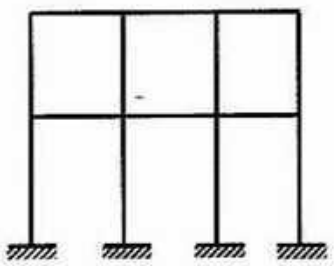
12. Calculate the deflection at A and the rotation at B for the following beam [Given: EI = 40,000 k-ft^2].



13. Calculate σ_{cr} if $\sigma = 40\,\varepsilon - 20\,\varepsilon^2$ and η is (a) π, (b) 2π

14. Calculate the buckling load in column AB if the frame is (i) braced, (ii) unbraced [Given: EI = 40,000 k-ft^2].





University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Fluid Mechanics | Course No: CE 221
Time: 3.0 hour | Full Marks: 150

The symbols have their usual meanings.
The figures at the right margin indicate full marks.
There are **eight questions**. Answer **Question No. 6** as compulsory and **any five** from the rest.

1. (a) Define energy in fluid flow. Explain why a correction factor is applied while calculating the kinetic energy of fluid flow. 3+3=6
   (b) Derive the general equation of continuity for flow through pipes. Reduce the equation for steady incompressible flow. 8+2=10
   (c) In figure 1, the pipe AB is of uniform diameter. The pressure at A is 150 kN/m^2 and at B is 250 kN/m^2. If a crude oil (S = 0.85) is flowing through the pipe, determine the direction of flow and head loss. 9

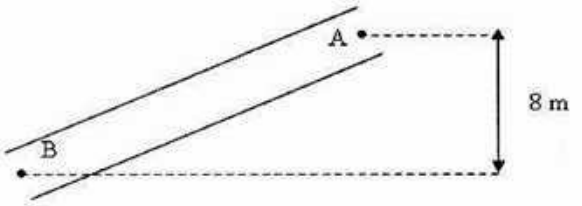


Figure 1

2. (a) Give a statement of the Bernoulli's energy equation. State the limitations of this equation. 2+3=5
   (b) The diameter of a pipe changes from 20 cm at a section 5 m above an arbitrarily selected datum to 5 cm at a section above the same datum. The pressure of water at the first section is 8 kg/cm^2. If the velocity at the first section is 80 cm/s, determine the intensity of pressure at the second section. Neglect losses. 12
   (c) Distinguish between hydraulic grade line and energy line. 8

3. (a) Determine the magnitude and direction of the resultant force exerted on the double nozzle as shown in figure 2. Both nozzle jets have a velocity of 12 m/s. The axis of the pipe and both nozzles lie in a horizontal plane, γ = 9.81 kN/m^3. Neglect friction. 20

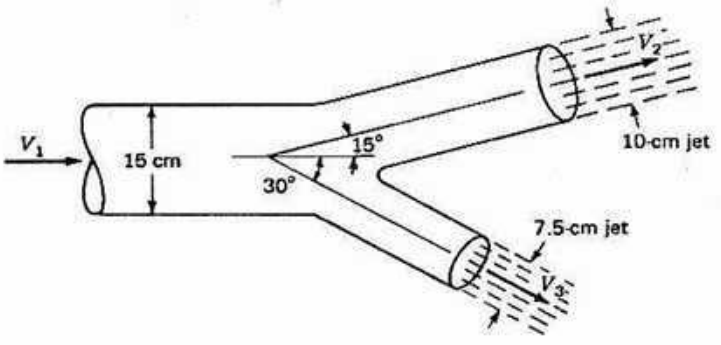


Figure 2

(b) State the impulse momentum principle for steady flow. 5

4. (a) Write short note on dynamic similarity. 5

(b) Find the horizontal thrust of the water on each meter width of the sluice gate as shown in figure 3. Given, $y_1 = 2.0$ m, $y_2 = 0.35$ m, $a = 0.6$ m. Neglect friction. 12

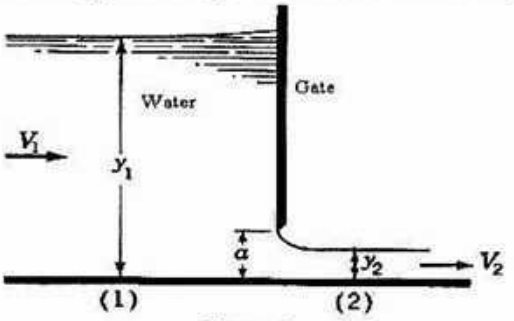


Figure 3

(c) A ship of 120 m length is to be tested by a model 3 m long. If the ship travels at 56 km/h, at what speed must the model be towed for dynamic similitude between model and prototype? If the drag of the model is 9 N, what prototype drag is to be expected? 8

5. (a) What do you mean by dimensional analysis? Consider the drag force F_D exerted on a sphere as it moves through a viscous liquid. Certainly, the size of the sphere must influence the drag force. Also, the velocity of the sphere must be important. The fluid properties involved are the density ρ and the viscosity μ. Derive an expression for the drag force on the sphere by Buckingham's π Theorem. 2+13 =15

(b) A pipeline 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 20 cm in diameter and its diameter suddenly enlarges to 40 cm. The height of water level in the tank is 8 m above the center of the pipe. Considering all losses of head that occurs, determine the rate of flow. Assume $f = 0.02$ for both the pipes. 10

6. (a) What do you mean by critical Reynolds number? Distinguish between laminar and turbulent flow. 7

(b) Two reservoirs with a difference in water surface elevation of 6 m are connected by two pipes in series as shown in figure 4. The equivalent roughness heights of the two pipes are 2.0 and 0.3 mm respectively. Find discharge by equivalent velocity head method. Given $\nu = 3\times10^{-6}$ m^2/s. Use Moody diagram for friction factor. 18

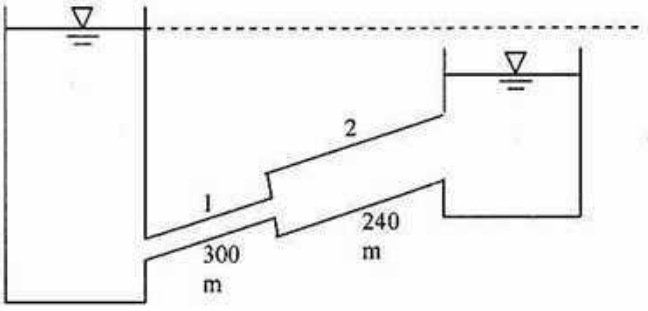


Figure 4

7. (a) The pipes in the system shown in figure 5 are all new cast iron (e = 0.25 mm). With a flow of 0.60 m^3/s, find the head loss from B to C. Given $\nu = 1.14\times10^{-6}$ m^2/s. 15

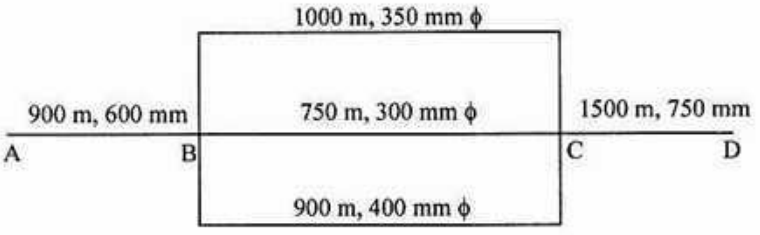


Figure 5

(b) If the flows into and out of a two-loop pipe system are as shown in figure 6, determine the flow in each pipe. The k-values for each pipe are given in the figure. Use Hardy Cross method. 10

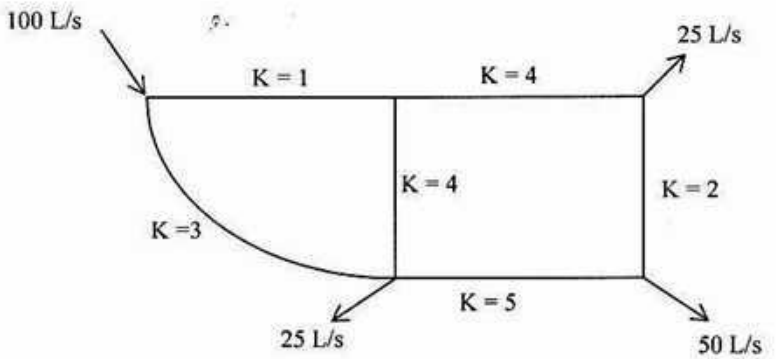


Figure 6

8. (a) State the importance of fluid measurement. Name some devices used for fluid measurement. 4+3=7

(b) What is a venturimeter? Derive an expression for theoretical discharge through a venturimeter. 2+7=9

(c) A 60 mm diameter orifice is discharging water under a head of 9 m. Calculate the actual discharge in liters per second and actual velocity of the jet at the vena contracta, if $C_d = 0.62$ and $C_v = 0.96$. 9

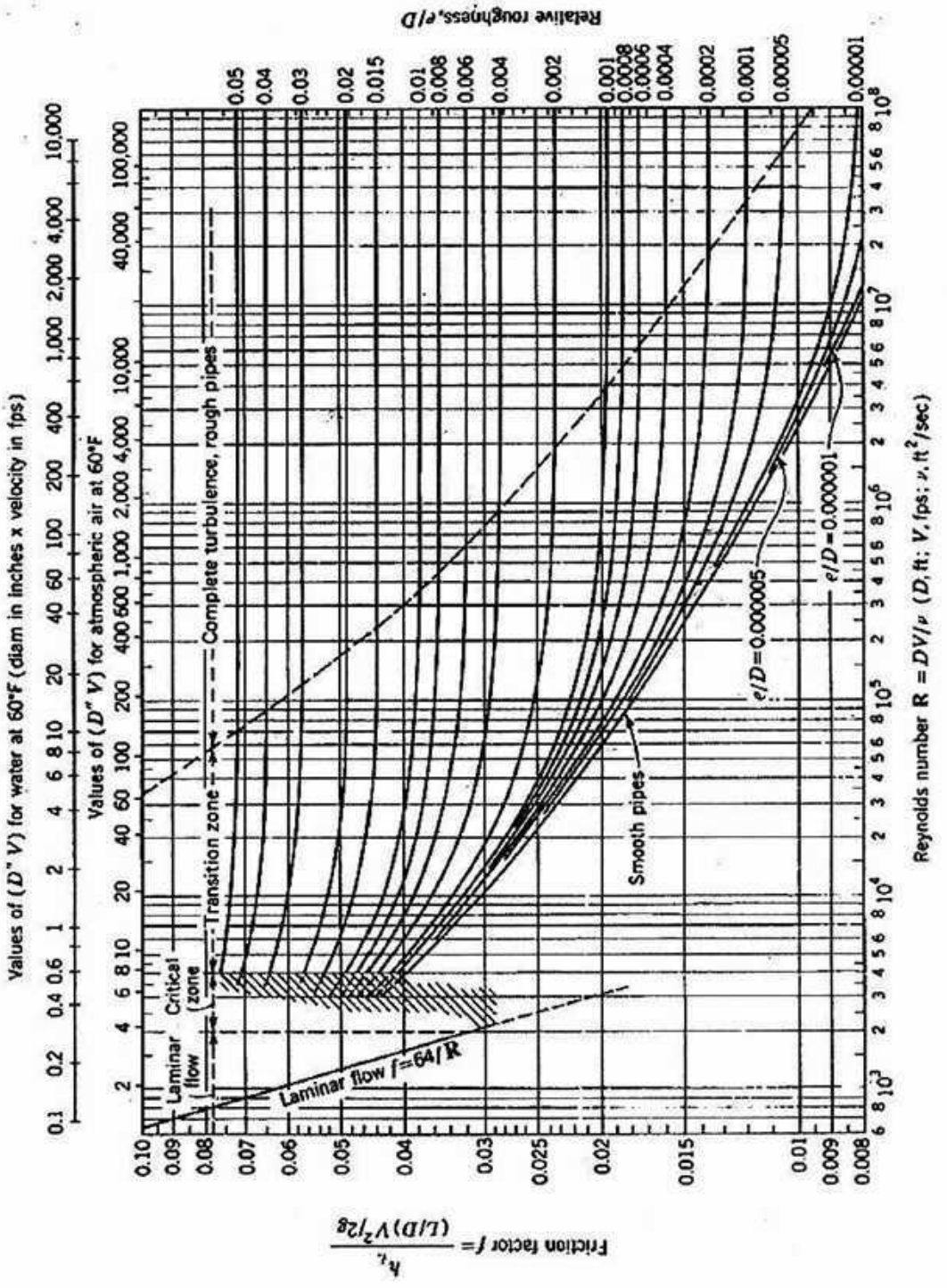


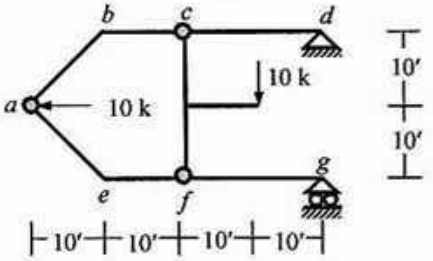
Figure: friction factor for pipes (Moody Diagram)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011 (Set B)
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]

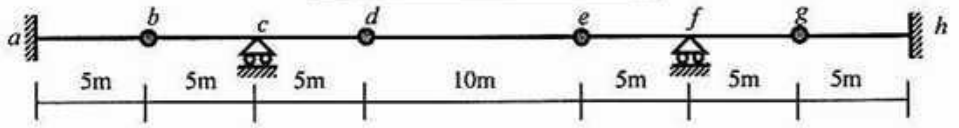
1. Determine the degree of statical indeterminacy (dosi) of the frame *abcdefg* shown below. Also draw the Axial Force, Shear Force and Bending Moment diagram of members *ab*, *bc* and *cd*.



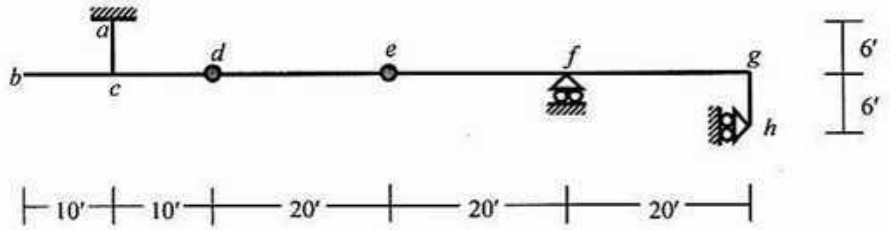
a, *c* and *f* are Internal Hinges

2. Determine the degree of statical indeterminacy (dosi) of the beam *abcdefgh* shown below. Also draw the influence lines of (i) R_a, R_c, (ii) $V_{c(Left)}$, $V_{f(Left)}$, (iii) M_c, M_h.

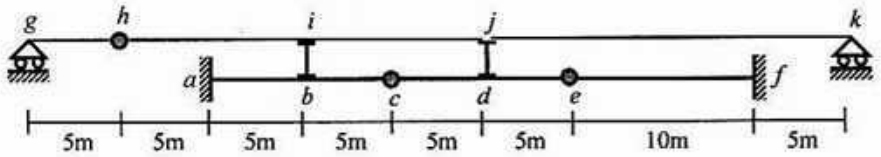
b, *d*, *e* and *g* are Internal Hinges



3. Determine the degree of statical indeterminacy (dosi) of frame *abcdefgh* shown below and draw influence lines of support reactions X_a, Y_a, R_f, if unit load moves over (i) beam *bg*, (ii) column *gh*.

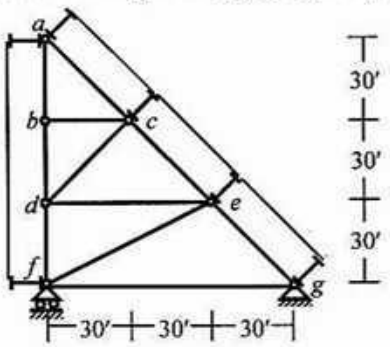


4. Draw the influence lines of R_a, $V_{d(Left)}$, $V_{d(Right)}$ and M_f for the plate girder *abcdef* shown below.

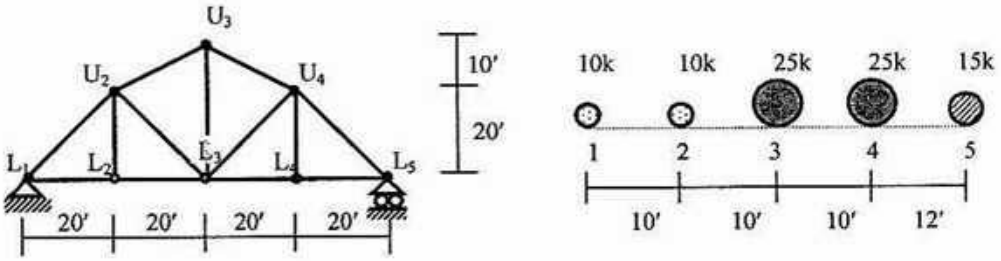


Internal Hinge

5. Draw the influence lines of the support reaction at *f* and forces in members *ab*, *ac* for the truss shown below, if unit load moves over stringers on (i) *af*, (ii) *aceg*.

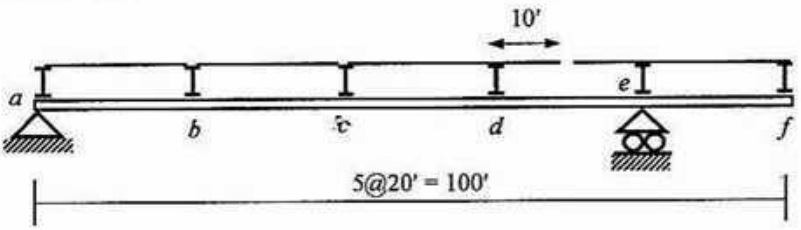


6. For the truss shown below, calculate the maximum tensile force in member U_4L_3 for the wheel loads shown below (when load moves over bottom cord).



7. For the truss and wheel loads shown in ***Question 6***, calculate the maximum compressive force in member U_4L_3.

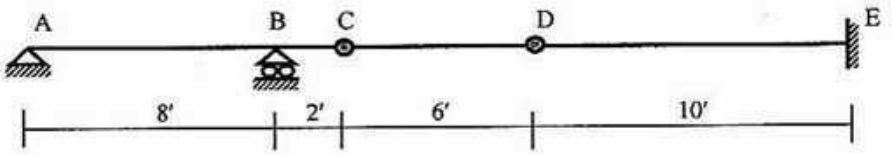
8. For the wheel loads shown in ***Question 6***, calculate the maximum value of FBR_b for the plate girder shown below.



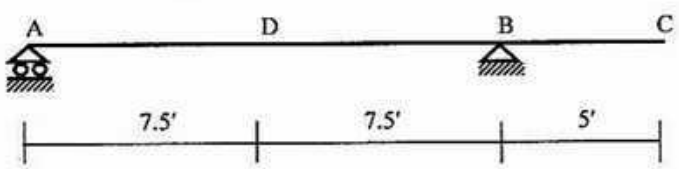
9. For the plate girder and wheel loads considered in ***Question 8***, calculate the maximum value of FBR_e.

10. Calculate the maximum tensile and compressive force in member U_4L_3 of truss shown in ***Question 6*** for a uniformly distributed dead load of 0.5 k/ft and moving uniformly distributed live load of 1 k/ft (when load moves over bottom cord).

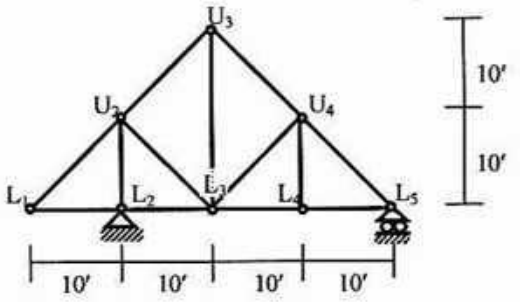
11. For the beam shown below, calculate the maximum positive value of reaction at support B and negative value of moment at support B for a uniformly distributed dead load of 2 k/ft, moving uniformly distributed live load of 3 k/ft and a moving concentrated load of 15 k [C and D are internal hinges].



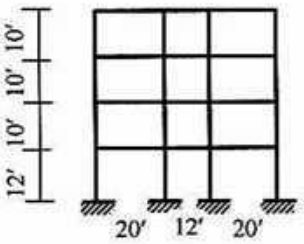
12. Draw the design bending moment diagram of beam ADBC shown below [based on influence lines of moment at midpoint of D and moment at support B] for a uniformly distributed dead load of 1.5 k/ft and a moving uniformly distributed live load of 1.0 k/ft.



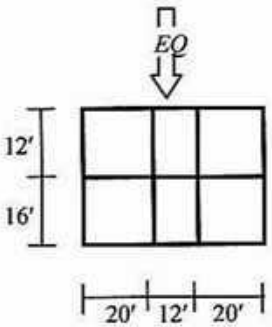
13. Calculate the design wind forces (both vertical and horizontal) on both sides of the structural truss shown below, which is situated in hilly terrain of Chittagong (with H = 25′, L_u = 100′) at Exposure C if the wind blows from left. The structure is used as cogeneration power plant that doesn't supply power on national grid (i.e., standard occupancy). Assume, bay = 30 ft.



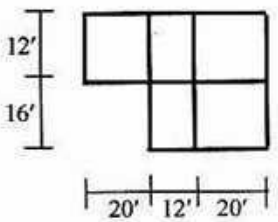
14. Use the Equivalent Static Force Method to calculate the seismic load at each story of a four-storied residential building (shown below) located in Dhaka (in Zone 2). Assume the structure to be an Ordinary Moment Resisting Frame (OMRF) built on soft to medium stiff clay soil and also assume each beam to weigh 2.5 k/ft.



Side Elevation



Plan
(Floor 1 and Floor 2)



Plan
(Floor 3 and Floor 4)

List of Useful Formulae for CE 311(B)

* dosi (for 2D Truss) = $m + r - 2j$ dosi (for 2D Frame) = $3m + r - 3j - h$
* dosi (for 3D Truss) = $m + r - 3j$ dosi (for 3D Frame) = $6m + r - 6j - h$

* $\Delta R = \{(\sum P)\, d_1 + P'e\}/L - P_1$
* $\Delta V = (\sum P)\, d_1 /L + P'\, e/L + P_0\, e_0/L - P_1$
* $\Delta M = (P_2\, d_1 + P'e)\ (i/b) - (P_1\, d_1 + P_0\, e_0)\ (i/a)$
* $M_{(Max)} = (\sum P/L)\ (L/2 - a/2)^2 - P\, b$
* $(W_1/P) \times (s + a)/s \geq W/L$
* $(W_1/P) \times (s + a + P)/(s + L) \geq W/L$
* $W_1/a \geq W/L$
* $W_1/P \geq W/L$

* The design wind pressure at a height z is $p_z = 0.00256\, C_I\, C_z\, C_G\, C_t\, C_p\, V_b^2$, design wind force $F_z = B\, h_{eff}\, p_z$

Location	V_b (mph)
Dhaka	130
Chittagong	160
Rajshahi	95
Khulna	150

Category	C_I
Essential facilities	1.25
Hazardous facilities	1.25
Special occupancy	1.00
Standard occupancy	1.00

C_p for Frames

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

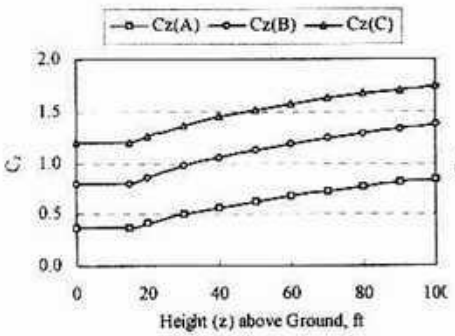


Fig. 1.1: Height and Exposure Coefficient, C_z

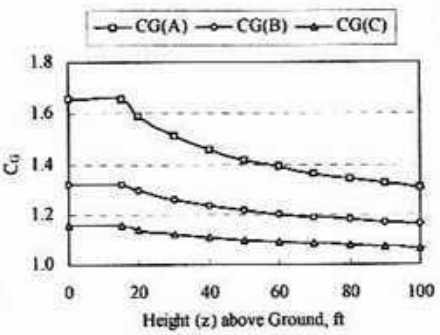


Fig. 2.1: Gust Response Factor, C_G

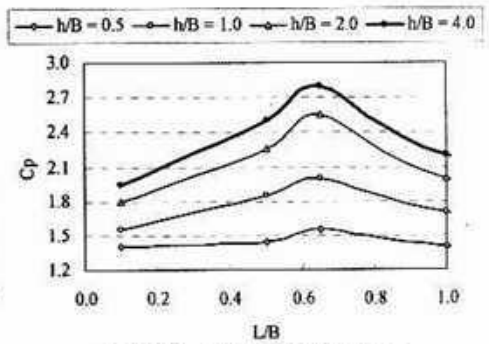


Fig. 3.1: Overall Pressure Coefficient, Cp

$H/2L_u$	C_t
0.05	1.19
0.10	1.39
0.20	1.85
0.30	2.37

For the windward surfaces of trusses
$C_p = -0.7$, for $0 \leq \alpha \leq 20°$
$C_p = (0.07\alpha - 2.1)$, for $20° \leq \alpha \leq 30°$
$C_p = (0.03\alpha - 0.9)$, for $30° \leq \alpha \leq 60°$
$C_p = 0.9$, for $60° \leq \alpha \leq 90°$
For leeward surface, $C_p = -0.7$, for any value of α

* Seismic design base shear is $V = (ZIC/R)\ W$ where $C = 1.25\ S/T^{2/3}$
  [Z = 0.075, 0.15 and 0.25 for Seismic Zones 1, 2 and 3 of Bangladesh respectively]
* $F_t = 0.07\ TV \leq 0.25V$ when $T > 0.7$ second, and = 0, when $T \leq 0.7$ second
* $F_j = (V - F_t)\ [w_j\, h_j / \sum w_i\, h_i]$
* Structural Period $T = C_t(h_n)^{3/4}$, where, $C_t = 0.083$ for steel moment resisting frames, 0.073 for RC moment-resisting frames and eccentric braced steel frames, 0.049 for all other structural systems

Response Modification Coefficient, R (Moment Resisting Frames)

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

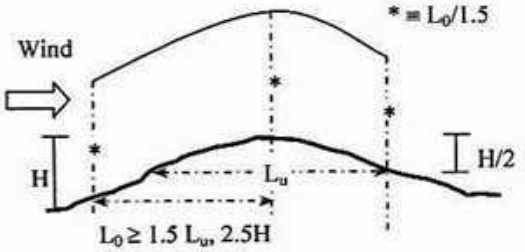
Site Coefficient, S

Type	Coefficient S
S_1	1.0
S_2	1.2
S_3	1.5
S_4	2.0

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

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

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



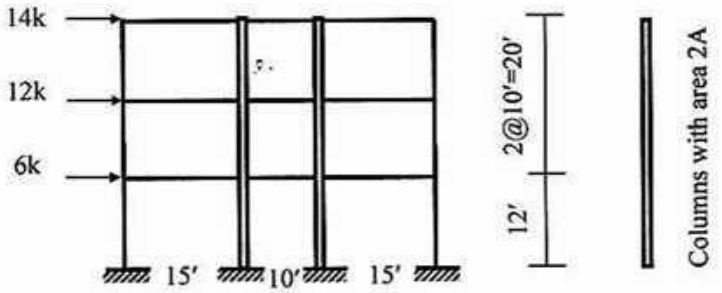
$H/2L_u$	C_1
0.05	1.19
0.10	1.39
0.20	1.85
0.30	2.37

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011(Set A)
Program: B.Sc. Engineering (Civil)

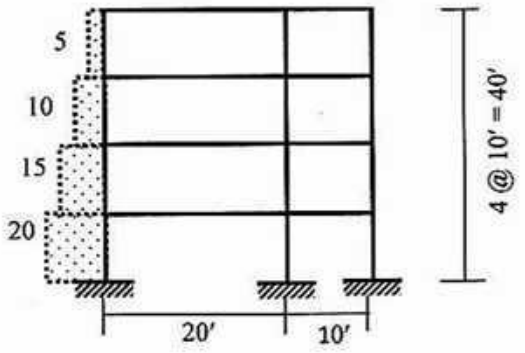
Course Title: Structural Engineering II | Credit Hours: 3.0 | Course Code: CE 313
Time: 3 hour | Full Marks: 90 (9x10)

(There are 13 questions. Answer **any 9)**

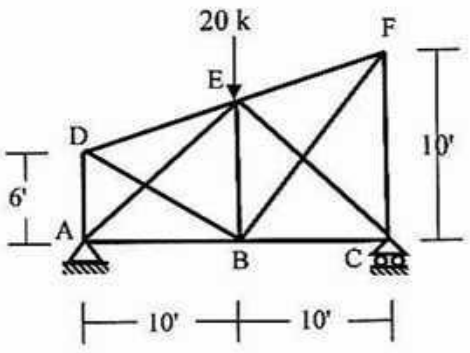
1. Use the Cantilever Method to draw AFD of columns and SFD, BMD of beams of the three-storied frame structure loaded as shown below.



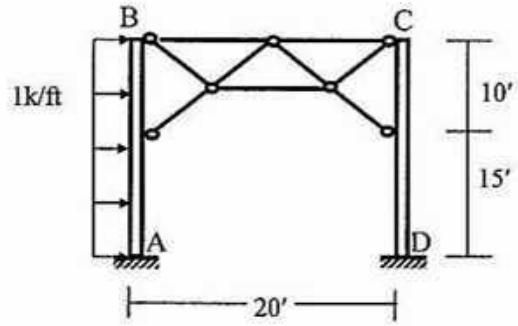
2. The figure below shows the exterior column shear forces (kips) in a four-storied fame. Using the Portal Method, calculate (i) the applied loads, (ii) beam shear forces.



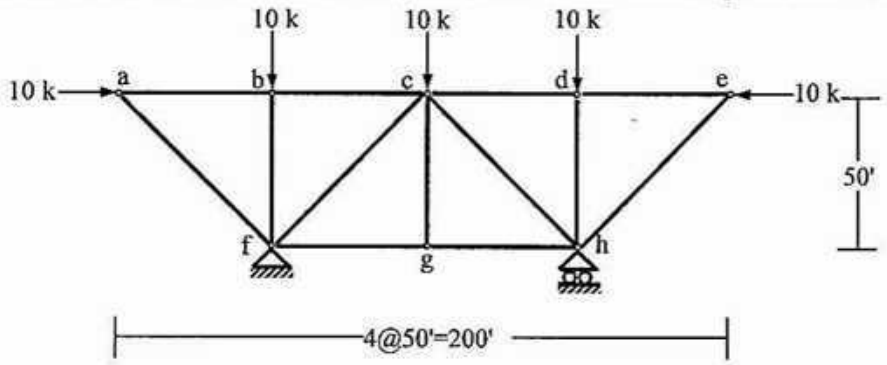
3. Determine the member forces of the diagonals of the truss shown below. Assume that the diagonals can carry only tension.



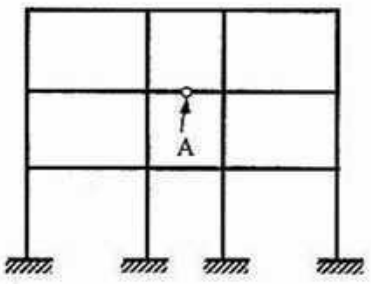
4. In the bridge portal loaded as shown below, draw the approximate bending moment diagrams of columns AB and CD.



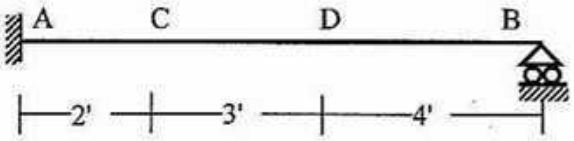
5. Use the Unit Load Method to calculate the vertical deflection at joint c of the truss shown below due to (i) applied load (ii) temperature drop of 20°F in the bottom cords
[Given: EA/L = constant = 1000 k-ft, Co-efficient of thermal expansion $\alpha = 5.5 \times 10^{-6}/^{0}F$].



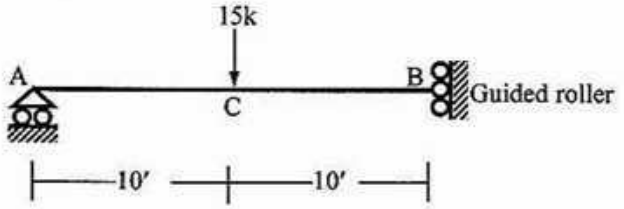
6. (i) Draw the qualitative influence line for M_A for the following frame.



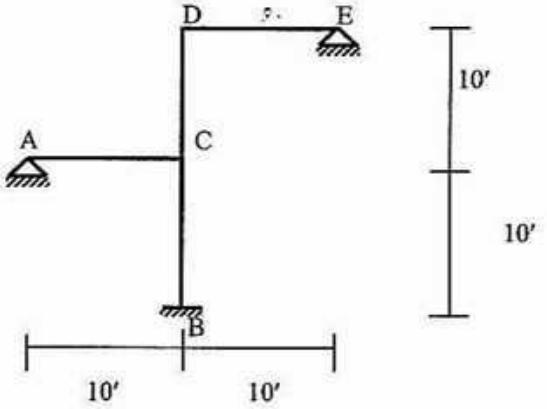
(ii) Draw the influence line for the vertical reaction at B and determine the quantitative value at A,B,C and D. [Given: EI = constant].



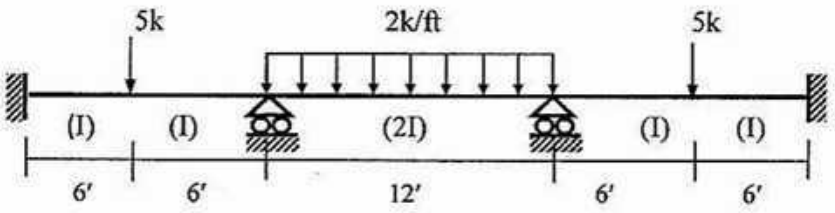
7. Calculate the vertical deflection at point C of the beam shown below using virtual work method. [Given EI= 40,000k-ft^2].



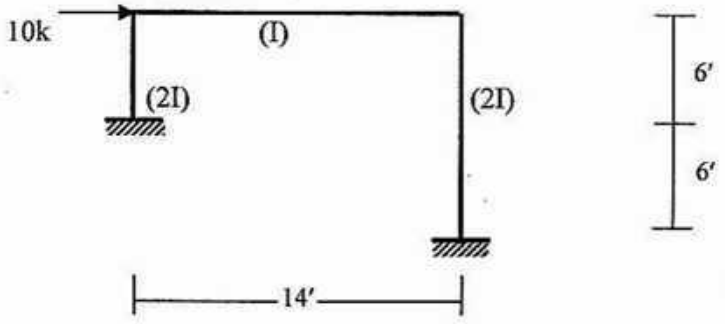
8. Both A and B settle down by 1″ in the following frame. Use the moment distribution method to calculate the joint moments and draw the bending moment diagram of the frame [Given: EI= 40000 k-ft]^2.



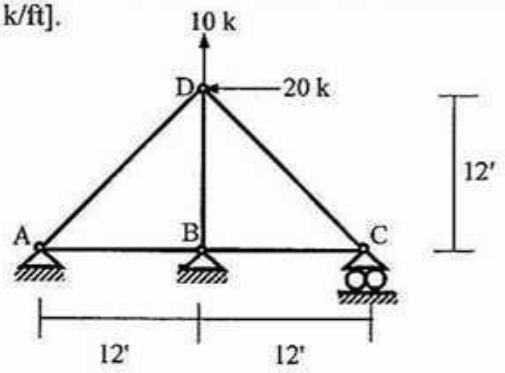
9. Use moment distribution method to draw the SFD and BMD of the following beam.



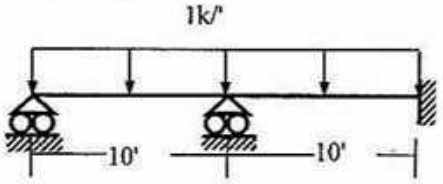
10. Calculate joint moments and draw BMD for the following frame using moment distribution method.



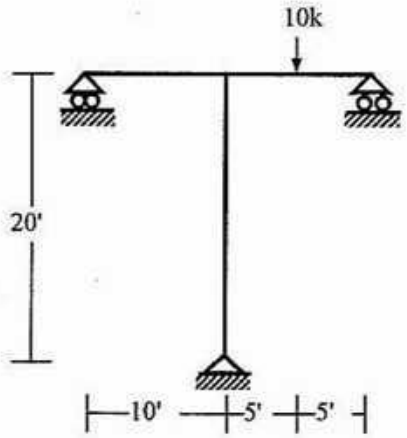
11. Use the Flexibility Method to calculate the bar forces of the truss shown below when C settles down 0.1'[Given: EA/L = 1000 k/ft].



12. Use the Flexibility Method to calculate the support reactions and draw the BMD of the beam shown below [Given: EI = 40×10^3 k-ft^2].



13. Use the Flexibility Method to draw the (i) AFD (ii) SFD and (iii) BMD of the frame shown below. [Given : EA = 400×10^3 k, GA* = 125×10^3 k, EI = 40×10^3 k-ft^2].



List of Useful Formulae for CE 313

* Portal Method for multi-storied frames assumes
  - The shear force in an interior column is twice the shear force in an exterior column.
  - There is a point of inflection at the center of each column, and at the center of each beam.
* Cantilever Method is based on three assumptions
  - The axial force in each column of a story is proportional to its horizontal distance from the center of gravity of all the columns of the story.
  - There is a point of inflection at the center of each column, and at the center of each beam.

* Vertical Analysis based on approximate location of hinges
  $M_{(+)} = 0.08\ wL^2$, $M_{(-)} = 0.045\ wL^2$, $V_{(+)} = wL/2$, and $V_{(-)} = -wL/2$
* Vertical Analysis using ACI Coefficients
  $M_{(+)}$ (i) For end spans, if discontinuous end is (a) unrestrained = $wL^2/11$, (b) restrained = $wL^2/14$
  (ii) For interior spans = $wL^2/16$
  $M_{(-)}$ (i) At the exterior face of first interior supports for (a) Two spans = $wL^2/9$, (b) More spans = $wL^2/10$
  (ii) At the other faces of interior supports = $wL^2/11$
  (iii) For spans not exceeding 10', of where columns are much stiffer than beams = $wL^2/12$
  (iv) At the interior faces of exterior supports, if the support is (a) a beam = $wL^2/24$, (b) a column = $wL^2/16$
  V (i) In end members at first interior support = $\pm$ 1.15wL/2, (ii) At all other supports = $\pm$ wL/2
* Deflection of truss due to load, temperature change and misfit, $\Delta = \Sigma N_i\, dL = \Sigma N_i (N_0 L/EA + \alpha \Delta T\, L + \Delta L)$
* Deflection of beams/frames due to axial, shear and flexural deformation,
  $\Delta = \int (x_i x_0/EA)\, dS + \int (v_i v_0/GA^*)\, dS + \int (m_i m_0/EI) dS$

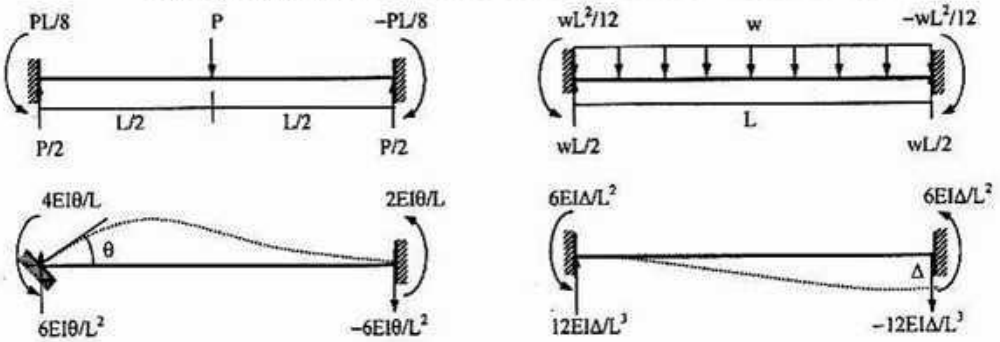
Integration of Product of Functions ($I = \int f_1 f_2\, dS$)

f_2 \ f_1	A, L	B, L	A, L	A, B, L	A, C, B, L
a, L	AaL	BaL/2	AaL/2	(A+B)aL/2	[A+4C+B]aL/6
b, L	AbL/2	BbL/3	AbL/6	[A+2B]bL/6	[2C+B]bL/6
a, L	AaL/2	BaL/6	AaL/3	[2A+B]aL/6	[A+2C]aL/6
a, b, L	A(a+b)L/2	B(a+2b)L/6	A(2a+b)L/6	[A(2a+b)+B(a+2b)]L/6	[Aa+Bb+ 2C(a+b)]L/6

* dosi for 2D trusses = m + r – 2j, for 3D trusses = m + r – 3j
* dosi for 2D frames = 3m + r – h – 3j, for 3D frames = 6m + r – 3h – 6j
* Deflection of beams/frames due to axial, shear and flexural deformation,
  $\Delta_{i,j} = \int (x_i x_j/EA)\, dS + \int (v_i v_j/GA^*)\, dS + \int (m_i m_j/EI) dS$; $M = m_0 + F_1 m_1 + F_2 m_2 + \ldots\ldots$, etc.
* Compatibility of deflection $\Rightarrow \Delta_{i,0} + F_1 \Delta_{i,1} + F_2 \Delta_{i,2} + \ldots\ldots F_n \Delta_{i,n} = \Delta_i$; etc

* For member with fixed far end, Rotational stiffness = 4EI/L, Carry over factor = 0.5
* For member with hinged/roller/discontinuous far end, Rotational stiffness = 3EI/L, Carry over factor = 0
* The moment distribution factors of members OA, OB,..... are $[K_{OA}/K_O]$, $[K_{OB}/K_O]$,.....respectively

Fixed End Reactions for One-dimensional Prismatic Members under Typical Loadings

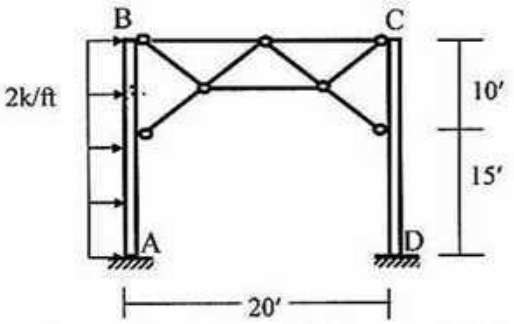


University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011(Set B)
Program: B.Sc. Engineering (Civil)

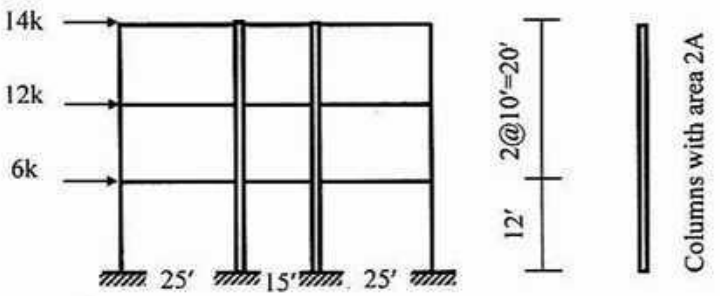
Course Title: Structural Engineering II | Credit Hours: 3.0 | Course Code: CE 313
Time: 3 hour | Full Marks: 90 (9x10)

(There are 13 questions. Answer **any 9)**

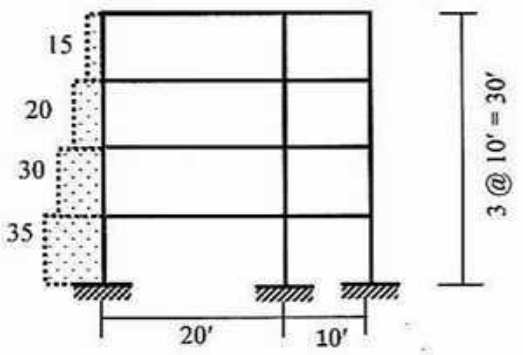
1. In the bridge portal loaded as shown below, draw the approximate bending moment diagrams of columns AB and CD.



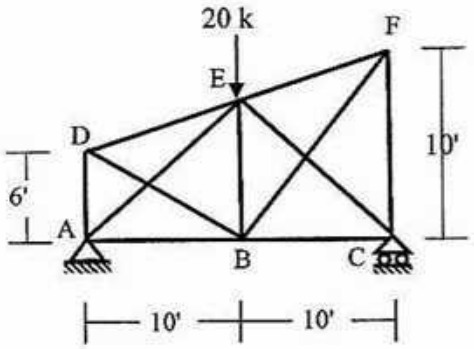
2. Use the Cantilever Method to draw AFD of columns and SFD, BMD of beams of the three-storied frame structure loaded as shown below.



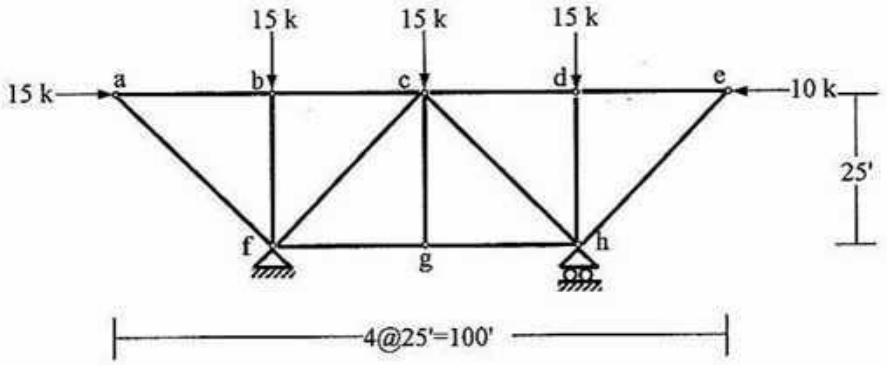
3. The figure below shows the exterior column shear forces (kips) in a four-storied fame. Using the Portal Method, calculate (i) the applied loads, (ii) beam shear forces.



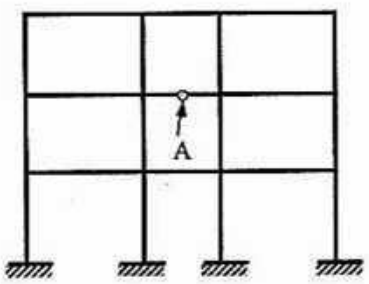
4. Determine the member forces of the diagonals of the truss shown below. Assume that the diagonals can carry only tension.



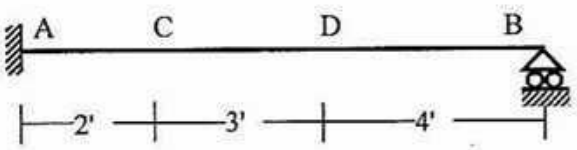
5. Use the Unit Load Method to calculate the vertical deflection at joint c of the truss shown below due to (i) applied load (ii) temperature drop of 20°F in the bottom cords
[Given: EA/L = constant = 1000 k-ft, Co-efficient of thermal expansion $\alpha = 5.5 \times 10^{-6}/^{0}F$].



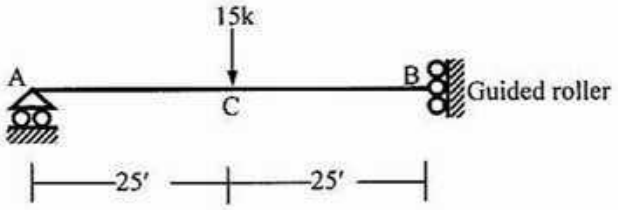
6. (i) Draw the qualitative influence line for M_A for the following frame.



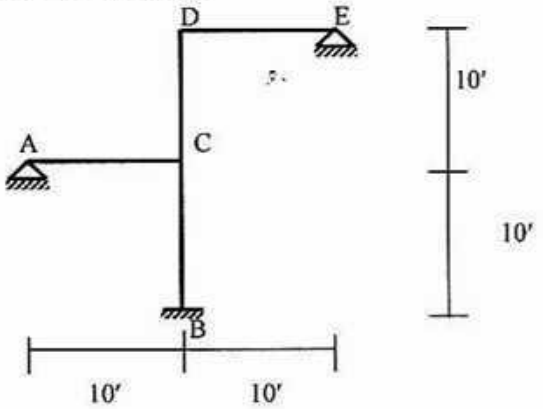
(ii) Draw the influence line for the vertical reaction at B and determine the quantitative value at A,B,C and D. [Given: EI = constant].



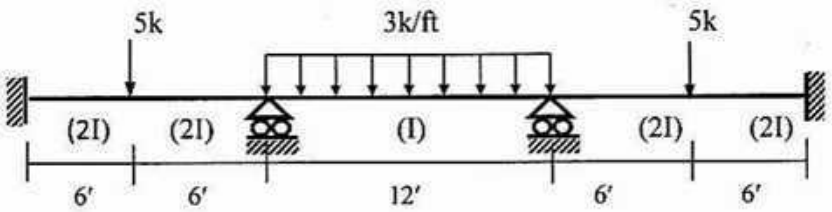
7. Calculate the vertical deflection at point C of the beam shown below using virtual work method. [Given EI= 40,000k-ft^2].



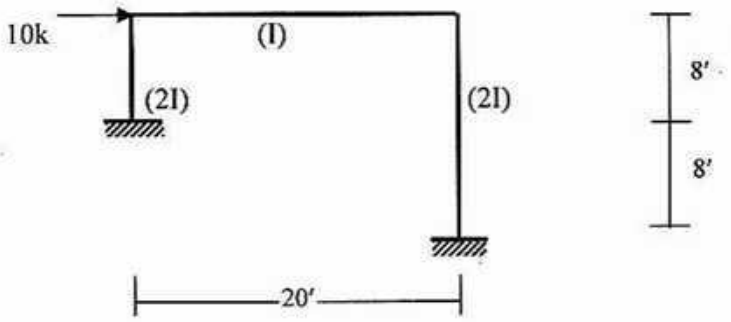
8. Both A and B settle down by 1″ in the following frame. Use the moment distribution method to calculate the joint moments and draw the bending moment diagram of the frame [Given: EI= 40000 k-ft]^2.



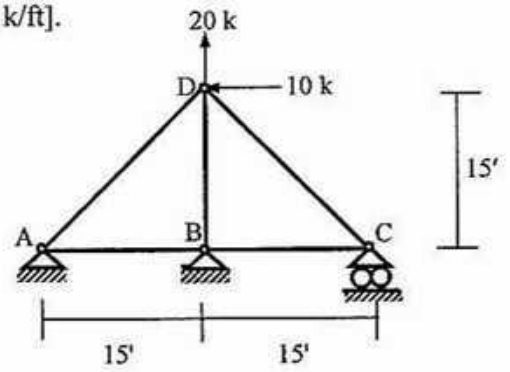
9. Use moment distribution method to draw the SFD and BMD of the following beam.



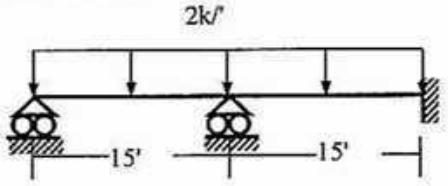
10. Calculate joint moments and draw BMD for the following frame using moment distribution method.



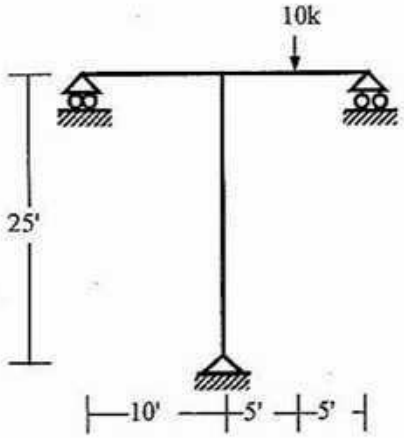
11. Use the Flexibility Method to calculate the bar forces of the truss shown below when C settles down 0.1'[Given: EA/L = 1000 k/ft].



12. Use the Flexibility Method to calculate the support reactions and draw the BMD of the beam shown below [Given: EI = 40×10^3 k-ft^2].



13. Use the Flexibility Method to draw the (i) AFD (ii) SFD and (iii) BMD of the frame shown below. [Given : EA = 400×10^3 k, GA* = 125×10^3 k, EI = 40×10^3 k-ft^2].



List of Useful Formulae for CE 313

* Portal Method for multi-storied frames assumes
  - The shear force in an interior column is twice the shear force in an exterior column.
  - There is a point of inflection at the center of each column, and at the center of each beam.
* Cantilever Method is based on three assumptions
  - The axial force in each column of a story is proportional to its horizontal distance from the center of gravity of all the columns of the story.
  - There is a point of inflection at the center of each column, and at the center of each beam.

* Vertical Analysis based on approximate location of hinges
  $M_{(+)} = 0.08\ wL^2$, $M_{(-)} = 0.045\ wL^2$, $V_{(+)} = wL/2$, and $V_{(-)} = -wL/2$
* Vertical Analysis using ACI Coefficients
  $M_{(+)}$ (i) For end spans, if discontinuous end is (a) unrestrained = $wL^2/11$, (b) restrained = $wL^2/14$
  (ii) For interior spans = $wL^2/16$
  $M_{(-)}$ (i) At the exterior face of first interior supports for (a) Two spans = $wL^2/9$, (b) More spans = $wL^2/10$
  (ii) At the other faces of interior supports = $wL^2/11$
  (iii) For spans not exceeding 10', of where columns are much stiffer than beams = $wL^2/12$
  (iv) At the interior faces of exterior supports, if the support is (a) a beam = $wL^2/24$, (b) a column = $wL^2/16$
  V (i) In end members at first interior support = $\pm$ 1.15wL/2, (ii) At all other supports = $\pm$ wL/2
* Deflection of truss due to load, temperature change and misfit, $\Delta = \Sigma N_1\, dL = \Sigma N_1 (N_0 L/EA + \alpha \Delta T\, L + \Delta L)$
* Deflection of beams/frames due to axial, shear and flexural deformation,
  $\Delta = \int (x_1 x_0/EA)\, dS + \int (v_1 v_0/GA^*)\, dS + \int (m_1 m_0/EI) dS$

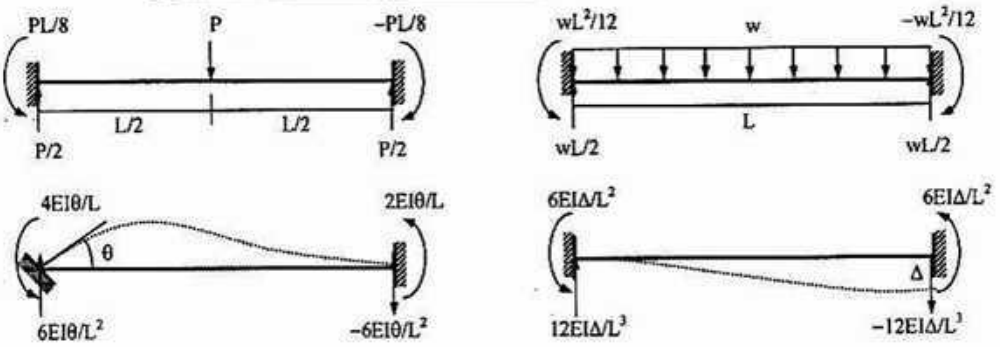
Integration of Product of Functions ($I = \int f_1 f_2\, dS$)

f_2 \ f_1	A L	B L	A L	A B L	A C B L
a L	AaL	BaL/2	AaL/2	(A+B)aL/2	[A+4C+B]aL/6
b L	AbL/2	BbL/3	AbL/6	[A+2B]bL/6	[2C+B]bL/6
a L	AaL/2	BaL/6	AaL/3	[2A+B]aL/6	[A+2C]aL/6
a b L	A(a+b)L/2	B(a+2b)L/6	A(2a+b)L/6	[A(2a+b)+B(a+2b)]L/6	[Aa+Bb+ 2C(a+b)]L/6

* dosi for 2D trusses = m + r – 2j, for 3D trusses = m + r – 3j
* dosi for 2D frames = 3m + r – h – 3j, for 3D frames = 6m + r – 3h – 6j
* Deflection of beams/frames due to axial, shear and flexural deformation,
  $\Delta_{i,j} = \int (x_i x_j/EA)\, dS + \int (v_i v_j/GA^*)\, dS + \int (m_i m_j/EI) dS$; $M = m_0 + F_1 m_1 + F_2 m_2 + \ldots\ldots$, etc.
* Compatibility of deflection $\Rightarrow \Delta_{i,0} + F_1 \Delta_{i,1} + F_2 \Delta_{i,2} + \ldots\ldots F_n \Delta_{i,n} = \Delta_i$; etc

* For member with fixed far end, Rotational stiffness = 4EI/L, Carry over factor = 0.5
* For member with hinged/roller/discontinuous far end, Rotational stiffness = 3EI/L, Carry over factor = 0
* The moment distribution factors of members OA, OB,..... are $[K_{OA}/K_O]$, $[K_{OB}/K_O]$,.....respectively

Fixed End Reactions for One-dimensional Prismatic Members under Typical Loadings



University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures | Credit Hours: 3.0 | Course Code: CE 315
Time: 3 hours | Full Marks: 200

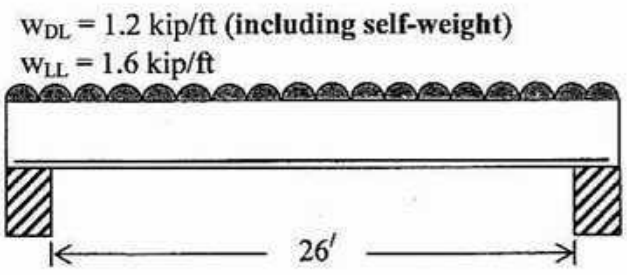
[Use ACI Code/USD method for all questions.
Tables are attached at the end to facilitate design.
Symbols carry their usual meanings. Assume reasonable values for any missing data]

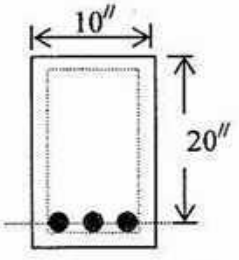
Section A: Question **1** *and* **2** *are both compulsory*

■ Question 1:

(a) Explain why development length for tension bars is greater than that of compression bars of a beam.	**(4)**
(b) Write down the minimum thickness required for one-way slabs for different end conditions specified by the ACI code.	**(4)**
(c) Explain why and when the maximum shear to be considered for design is computed at a distance of 'd' from face of the support.	**(4)**
(d) Write down the criteria to determine the effective width of T-beam.	**(4)**

■ Question 2: Determine the shear reinforcement and stirrup layout for the beam shown in Figure 1 and 2 [Given: $f_c' = 3000$ psi, $f_y = 60000$ psi].	**(24)**





Beam cross-section

Figure 1 and **2** for **Question 2**

Section B: *There are* **FIVE** *questions in this section* (Question **3** *to* 7).
Answer any **FOUR** *questions.*

■ Question 3:

(a) For the beam section shown in Figure 3(a), determine the balanced steel needed and maximum steel permitted as per the ACI code. Check whether the beam section is under-reinforced or not. Also determine the ultimate moment capacity (M_u) of the beam section [Given: $f_c' = 3000$ psi, $f_y = 40000$ psi].	**(20)**
(b) Assuming elastic cracked section, determine the depth of neutral axis 'kd' for the irregular beam section shown in Figure 3(b) [Given: $f_c' = 3000$ psi, $f_y = 40000$ psi].	**(10)**
(c) Figure 3(c) shows a simply supported beam as well its cross-section at support. Check if the anchorage of 3 # 9 bars at support is adequate according to the ACI Code. Assume support width of 12 inch, 2 inch cover [Given: $f_c' = 3000$ psi, $f_y = 40000$ psi, V_u (at support) = 42.44 kip, M_u (for cross-section at support) = 158.82 kip-ft].	**(10)**

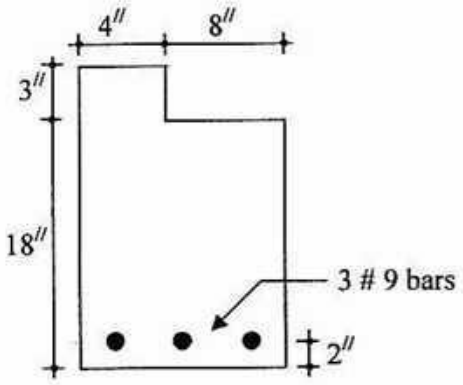


Figure 3(a) for **Question 3(a)**

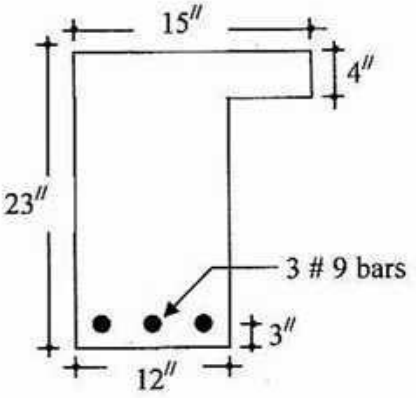


Figure 3(b) for **Question 3(b)**

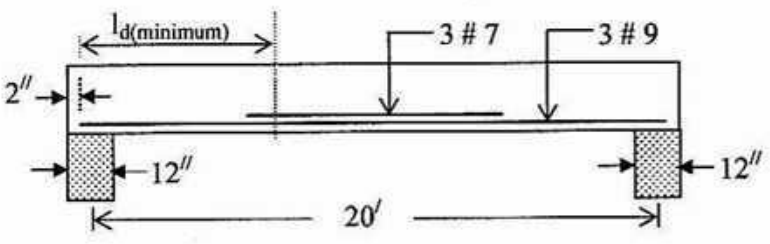
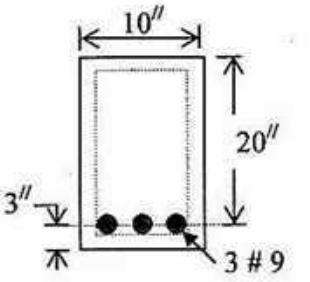


Figure 3(c) for **Question 3(c)**



Cross-section at support

■ Question 4:

(a) Design and detail the L-shaped beam 'B1' shown in Figure 4(a), assuming two layers of tension bars. After design, also check the reinforcement ratio as per ACI Code [Given: Span of beam = 20 feet (simply supported), $f_c' = 3000$ psi, $f_y = 60000$ psi].	**(20)**
(b) The top steel in the beam [shown in Figure 4(b)] has been designed for a flexural stress of $0.90f_y$ at the face of the column, which is the section of maximum negative moment. Determine the minimum required dimension of the column, if bars terminate with a 90° hook [Given: $f_c' = 4000$ psi, $f_y = 60000$ psi].	**(20)**

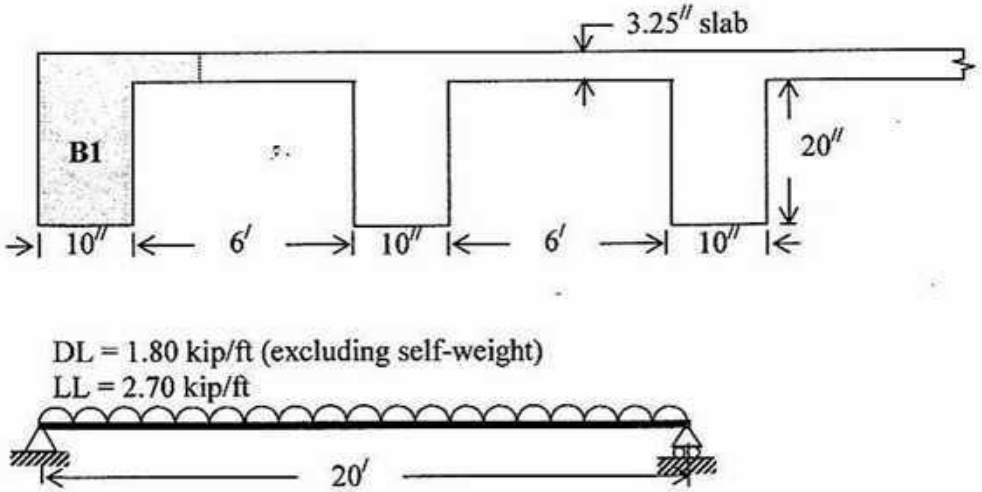


Figure 4(a) for **Question 4(a)**

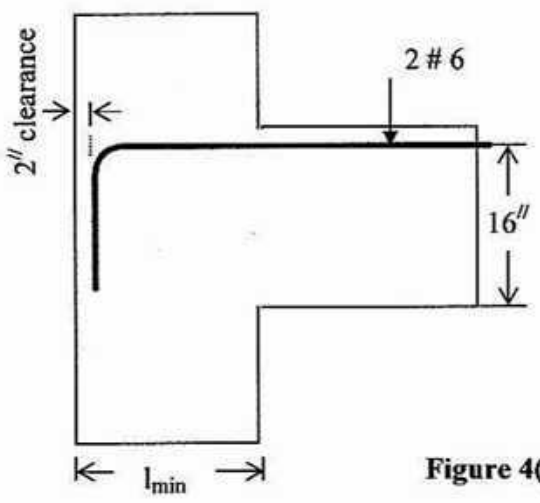


Figure 4(b) for **Question 4(b)**

■ Question **5**:

(a) The beam (simple span = 24 ft) shown in Figure 5 is to carry a dead load of 1 kip/ft (excluding self-weight) and a live load of 1.25 kip/ft. The reinforcements consist of 3 # 7 bars and 3 # 8 bars. Calculate the point where the upper 3 # 7 bars can be discontinued [Given: $A_{s,\,(supplied)} = A_{s,\,(required)}$, $f_c' = 4000$ psi, $f_y = 60000$ psi].	**(25)**
(b) In reference to Question 5(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, 2L @ 9 inch c/c].	**(15)**

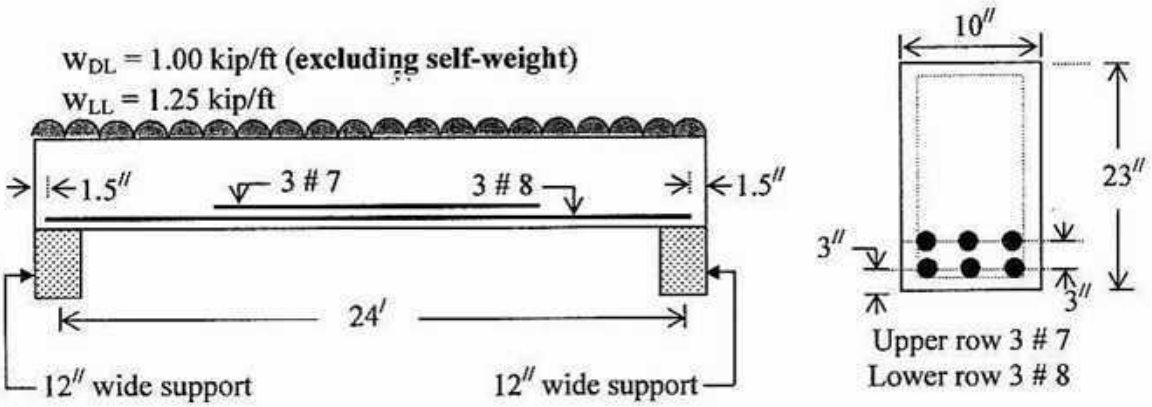


Figure 5 for **Question 5(a) & 5(b)**

■ Question **6**: Design the one-end overhanging one-way slab (shown in Figure 6) to support a service live load = 60 psf, floor finish = 20 psf and partition wall load = 80 psf. Note that live can occupy any position. Show the reinforcements both in plan and section with appropriate bar cut-off points [Given: $f_c' = 4000$ psi, $f_y = 50000$ psi].	**(40)**

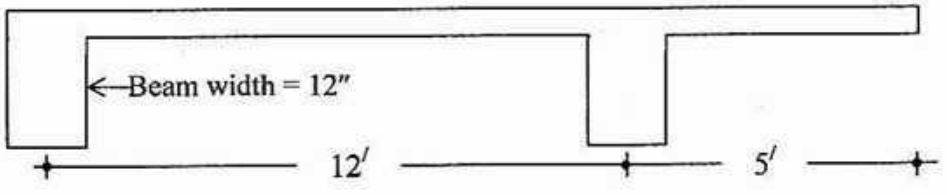


Figure 6 for **Question 6**

■ Question 7:

(a) If # 7 bars are to be spliced to # 8 bars for the tied column shown in Figure 7(a), what will be the minimum required lap length for the splice? [Given: $f_c' = 4500$ psi, $f_y = 50000$ psi].	**(10)**
(b) A floor system [shown in Figure 7(b)] is to consist of beams, girders and a slab. Service loads are to be 30 psf dead load (does not include the weight of the floor system) and 150 psf live load. Beam and girder width = 12 inch; column size = 16 inch × 16 inch. Design the continuous one-way slab (interior panel). Show reinforcements both in plan and section with appropriate bar cut-off points [Given: $f_c' = 4000$ psi, $f_y = 60000$ psi].	**(30)**

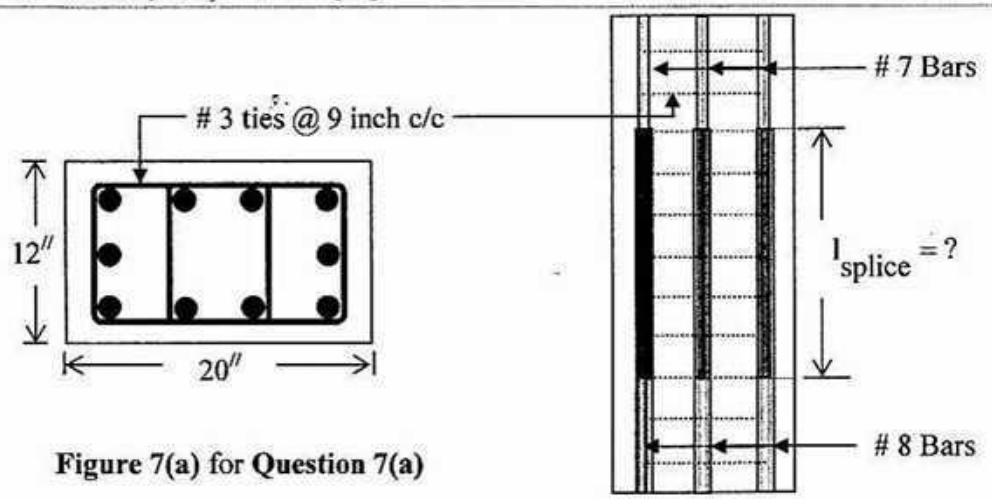


Figure 7(a) for **Question 7(a)**

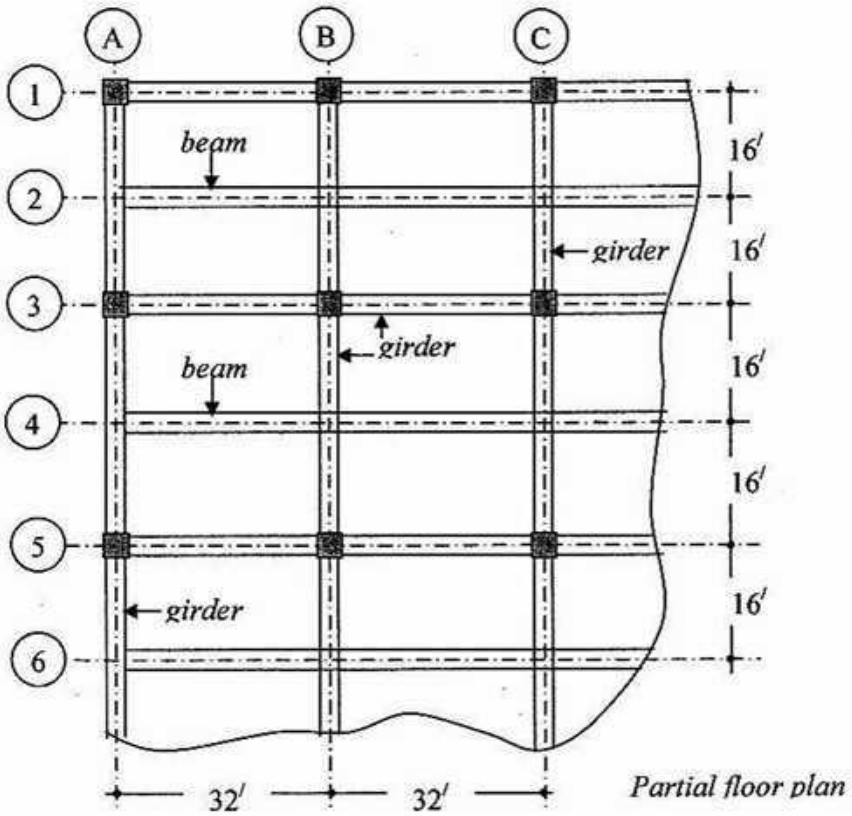


Figure 7(b) for **Question 7(b)**

Table 1: ACI moment co-efficients

			End span	Interior span
Positive Moment* (at midspan)	End unrestrained		$+\frac{1}{11}$	$+\frac{1}{16}$
	End restrained / integral with support		$+\frac{1}{14}$	$+\frac{1}{16}$
Negative Moment*	Interior Support	Two span	$-\frac{1}{9}$	$-\frac{1}{9}$
		Three or more span (span > 10 ft)	$-\frac{1}{10}$	$-\frac{1}{11}$
		Three or more span (span ≤ 10 ft)	$-\frac{1}{12}$	$-\frac{1}{12}$ $-\frac{1}{12}$ $-\frac{1}{12}$
	Exterior Support (members integral with support)	Support is spandrel beam	$-\frac{1}{24}$	
		Support is column	$-\frac{1}{16}$	
Shear	End span at first interior support		$1.15\frac{w_u l_n}{2}$	
	At all other supports		$\frac{w_u l_n}{2}$	$\frac{w_u l_n}{2}$

*multiply all moment co-efficients by $w_u l_n^2$ to get moment value

Table 2: Designations, areas, perimeters and weights of standard bars

Bar No.	Diameter (inch)	Cross sectional area (square inch)	perimeter (inch)
# 3	0.375	0.11	0.376
# 4	0.500	0.20	0.668
# 5	0.625	0.31	1.043
# 6	0.750	0.44	1.502
# 7	0.875	0.60	2.044
# 8	1.000	0.79	2.670
# 9	1.128	1.00	3.400
# 10	1.27	1.27	4.303
# 11	1.410	1.56	5.313
# 14	1.693	2.25	7.650
# 18	2.257	4.00	13.600

Table 3: Modifiers for development length in compression

Development length in compression, $l_d = \frac{0.02 d_b f_y}{\sqrt{f'_c}}$ or $0.0003 d_b f_y$

(for # 3 to # 18 bars)

	Modifier
Reinforcement in a flexural member in excess of that required by analysis (i.e., if $A_{s(supplied)} > A_{s(required)}$	$\frac{A_{s(required)}}{A_{s(supplied)}}$
Reinforcement enclosed within a spiral ≥ 0.25 inch diameter with pitch ≤ 4 inch	0.75

* Development length in compression must not less than 8 inch.

Table 4: Modifiers for development length in tension

Development length in tension,

$$l_d = \frac{0.04 A_b f_y}{\sqrt{f'_c}} \text{ or } 0.0004 d_b f_y \text{ (for \# 3 to \# 11 bars);}$$

$$l_d = \frac{0.085 f_y}{\sqrt{f'_c}} \text{ (for \# 14 bars), } l_d = \frac{0.11 f_y}{\sqrt{f'_c}} \text{ (for \# 18 bars)}$$

	Modifier
Top reinforcement (horizontal reinforcement so placed that more than 12 inch concrete is cast in the member below the bar)	1.4
Reinforcement with $f_y \geq 60000$ psi	$2 - \frac{60000}{f_y}$
Lightweight concrete	1.33
Reinforcement spaced laterally at least 6 inch on centers with at least 3 inch clear from face of member to edge of bar	0.80
Reinforcement in a flexural member in excess of that required by analysis (i.e., if $A_{s(supplied)} > A_{s(required)}$	$\frac{A_{s(required)}}{A_{s(supplied)}}$
Reinforcement enclosed within a spiral $\geq$ 0.25 inch diameter with pitch $\leq$ 4 inch	0.75

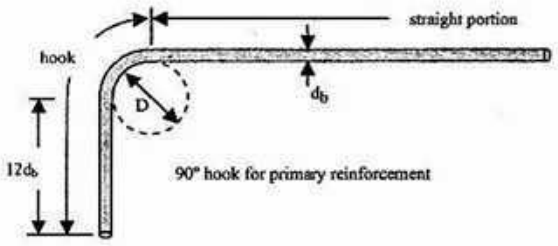
* development length in tension must not less than 12 inch.

** for bundle bars, development length of each bar is to increased by 20% for a three-bar bundle and 33 & for a four-bar bundle.

Table 5: Minimum diameters of bend for standard 90° & 180° hooks

Bar size	for 90° hooks		for 180° hooks
	Diameter of bend (D)		Diameter of bend (D)
	f_y = 40000 psi	f_y > 40000 psi	(for all values of f_y)
# 3 to # 8	5 d_b	6 d_b	6 d_b
# 9	5 d_b	8 d_b	8 d_b
# 10	5 d_b	8 d_b	8 d_b
# 11	5 d_b	8 d_b	8 d_b
# 14	.....	10 d_b	10 d_b
# 18	.....	18 d_b	18 d_b

* d_b = Bar diameter



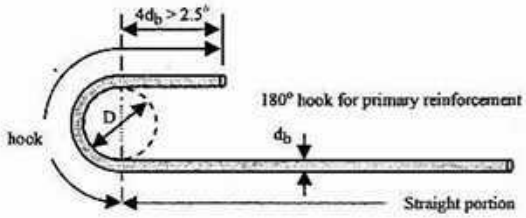


Table 6: ξ values

Bar number	f_y = 60000 psi		f_y = 40000 psi
	Top bars	Other bars	All bars
# 3, # 4 and # 5	540	540	360
# 6	450	540	360
# 7 and # 8	360	540	360
# 10	360	480	360
# 11	360	420	360
# 14	330	330	330
# 15	220	220	220

* $f_h = \xi\sqrt{f'_c}$; f_h = tensile force in hook

Table 7: Lap splice requirements for deformed bar in compression

	l_s	
	$f'_c \geq 3000$ psi	$f'_c < 3000$ psi
f_y = 40000 psi	20 d_b	26.67 d_b
f_y = 60000 psi	30 d_b	40 d_b
f_y = 75000 psi	44 d_b	58.67 d_b

* $l_s > l_d$; l_s = splice length in compression & l_d = development length in compression

Reinforcement in a compression member confined with ties (effective area of ties $\geq$ 0.0015bs; b = column dimension in inch & s = spacing of ties in inch)	0.83 l_d
Reinforcement in a compression member confined with continuous spirals	0.75 l_d

* splice length (l_s) in compression should not less than 12 inch

Table 8: lap splice requirements for deformed bar in tension

$\frac{A_{s(supplied)}}{A_{s(required)}}$	Minimum percent of A_s spliced within the required lap length		
	50%	75%	100%
≥ 2	$l_s = 1.0\ l_d$ (Class A)	$l_s = 1.0\ l_d$ (Class A)	$l_s = 1.3\ l_d$ (Class B)
< 2	$l_s = 1.3\ l_d$ (Class B)	$l_s = 1.7\ l_d$ (Class C)	$l_s = 1.7\ l_d$ (Class C)

* $l_s > l_d$; l_s = Splice length in tension, l_d = Development length in tension

* Splice length (l_s) in tension should not less than 12 inch

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc Engineering (Civil)

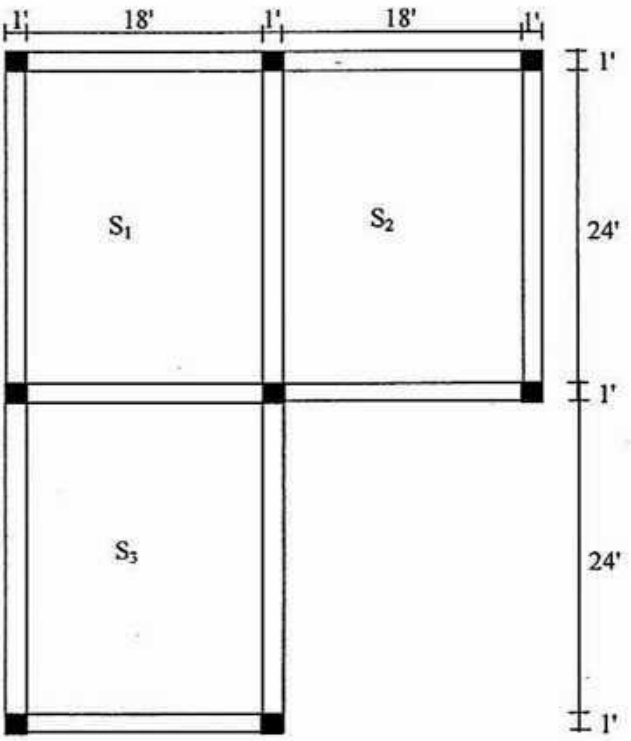
Course Title: Design of Concrete Structures II | Course Code: CE 317
Time: 3.00 Hours | Full Marks: 150

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

[Given: $f_c' = 4$ ksi, $f_y=60$ ksi, $f_s=24$ ksi, $j=0.866$, $R_{(wsd)}= 0.314$ ksi, $R_u=0.937$ ksi for all problems of Q1 to Q7]

1.(a) Refer to the following two way edge supported slab. The middle strip mid span and support factored moments are given below. Calculate the required reinforcements and show them in a neat sketch. Show corner reinforcements also. Draw plan and sections showing the reinforcements. **(20)**

Use **USD** method.



Given: Slab thickness, t=6"

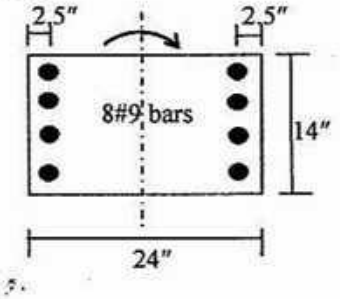
Factored moments are as follows:

Slab	Moment in Short direction (k-ft/ft)		Moment in Long direction (k-ft/ft)	
	At Mid span	At Support	At Mid span	At Support
S_1	+4.26	-7.1	+2.31	-3.98
S_2	+4.67	-8.21	+2.19	---
S_3	+4.90	---	+3.32	- 4.11

1.(b) What are the limitations in ACI Code for using semi-empirical direct design method (DDM) to determine moments in two-way slabs **(05)**

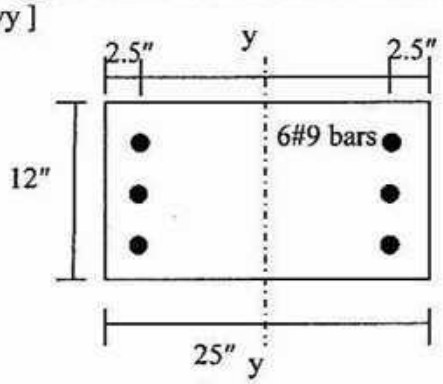
2.(a) What are the functions of ties in column? Write down the ACI specification regarding the size, spacing and arrangement of ties in reinforced concrete column. **(05)**

2.(b) Assume that the column shown below has a strain on its compression edge equal to -0.00300 and has a tensile strain of +0.00200 on its other edge. Determine the values of P_n and M_n which cause this strain distribution. **(10)**

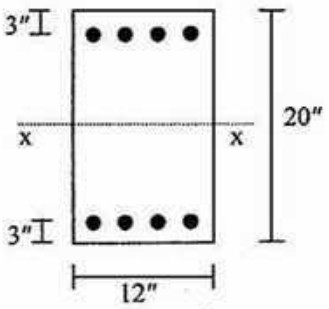


2.(c) Design a spiral column (also spiral) for DL= 1000 k , LL= 500 k . Assume, p_g=3.0%. Use **USD** method. **(10)**

3.(a) A column section with the main reinforcement is shown in the following figure. Using **WSD**, draw the interaction diagram for the column with at least five points including those corresponding to pure bending, pure axial load and balanced condition. [Given: S_{st}=2066 in^3, e_b=9.15", Axis of moment=yy] **(15)**

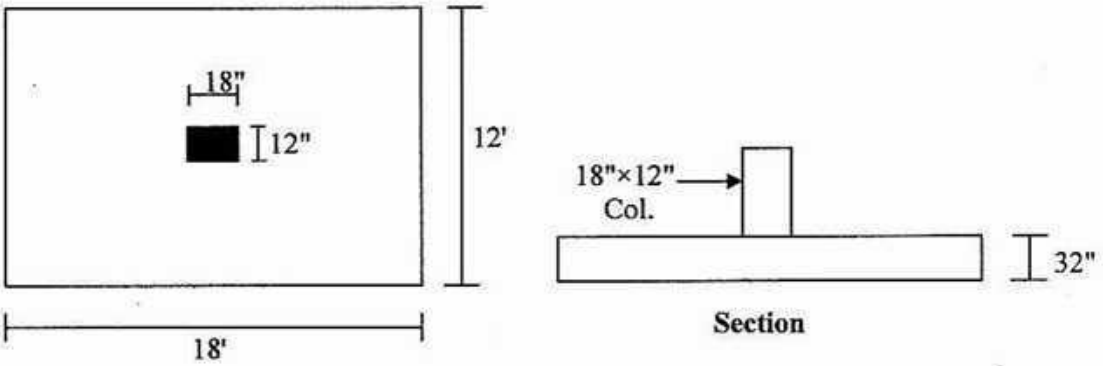


3.(b) The 12"×20" tied column of the following figure is to be used to support the following: P_u=327 k and M_u=220 k-ft. **(10)**
Use the interaction curve in the appendix to select reinforcing for the column.



(15)

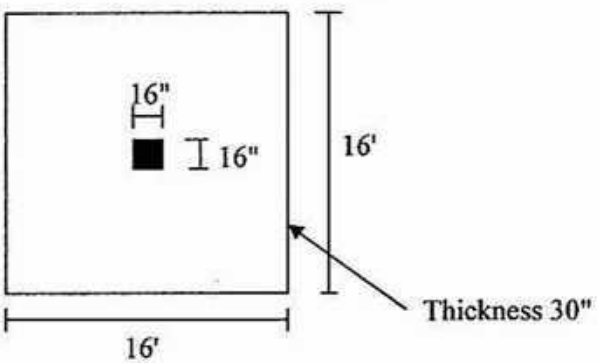
4.(a) A rectangular footing supporting a 18"×12" column with working loads of P_{DL}= 400 k and P_{LL}=200 k is shown in figure below. The total thickness of the footing is 32" which is adequate for all shears. Calculate only the necessary reinforcement for the footing and show them with necessary details in neat sketches. Use **WSD** method.



Plan **Section**

(10)

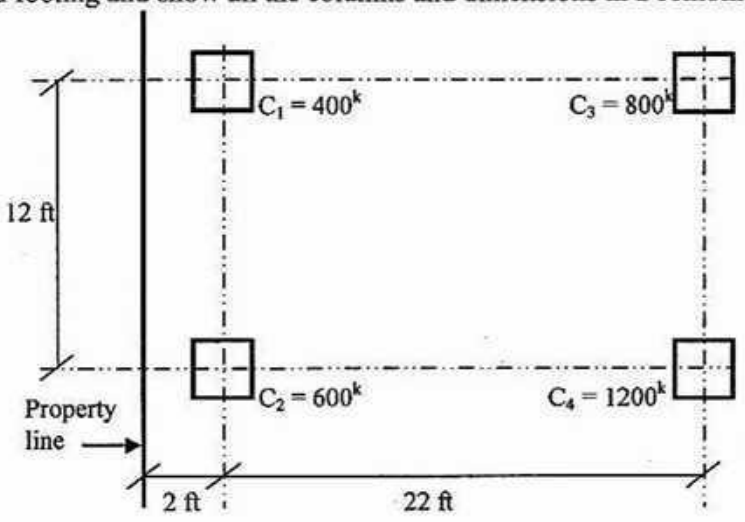
4.(b) The plan of a square footing of 30" thickness is shown in the following figure. The factored net upward pressure is 3.5 ksf. Check the adequacy of the thickness of the footing against punching shear, beam shear and moment. Use **USD** method.



Footing Plan

(10)

5.(a) The part plan of a structure as shown in figure below consists of column C_1, C_2, C_3 and C_4 carrying axial loads of 400^k, 600^k, 800^k and 1200^k respectively. If the allowable bearing capacity of the soil is 5 ksf and all the columns are 20"×20", calculate the area of the combined footing and show all the columns and dimensions in a combined footing layout.

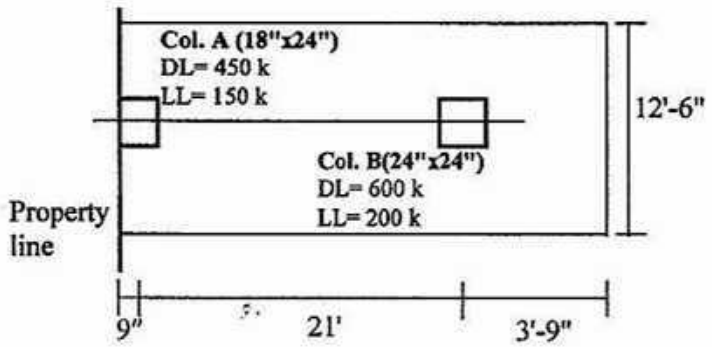


(15)

5.(b) A combined footing supporting two columns A and B (with working loads as given) is shown in figure below. Depth of footing is 46".

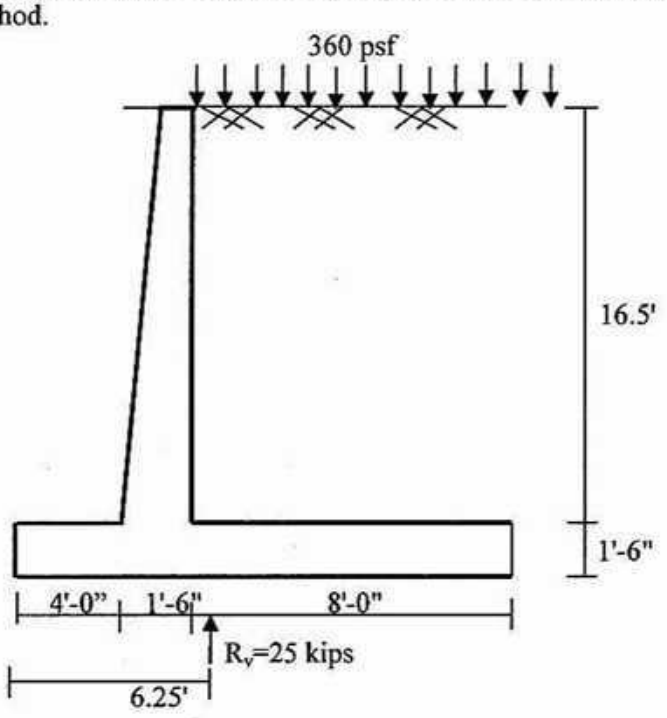
(a) Check the adequacy of the footing against punching shear under column A and column B.
(b) Design the transverse beams under the column A and column B.
(c) Show the designed transverse reinforcement in a section.

Use **WSD** method.



(15)

6.(a) A cross section of a retaining wall is shown in the following figure. If R_v, the vertical component of the reaction is equal to 25 kips and acts at a distance 6.25 ft from the toe as shown. Design the footing (heel slab and toe slab) of the retaining wall [Given: γ_s=120 lb/ft^3]. Use **WSD** method.

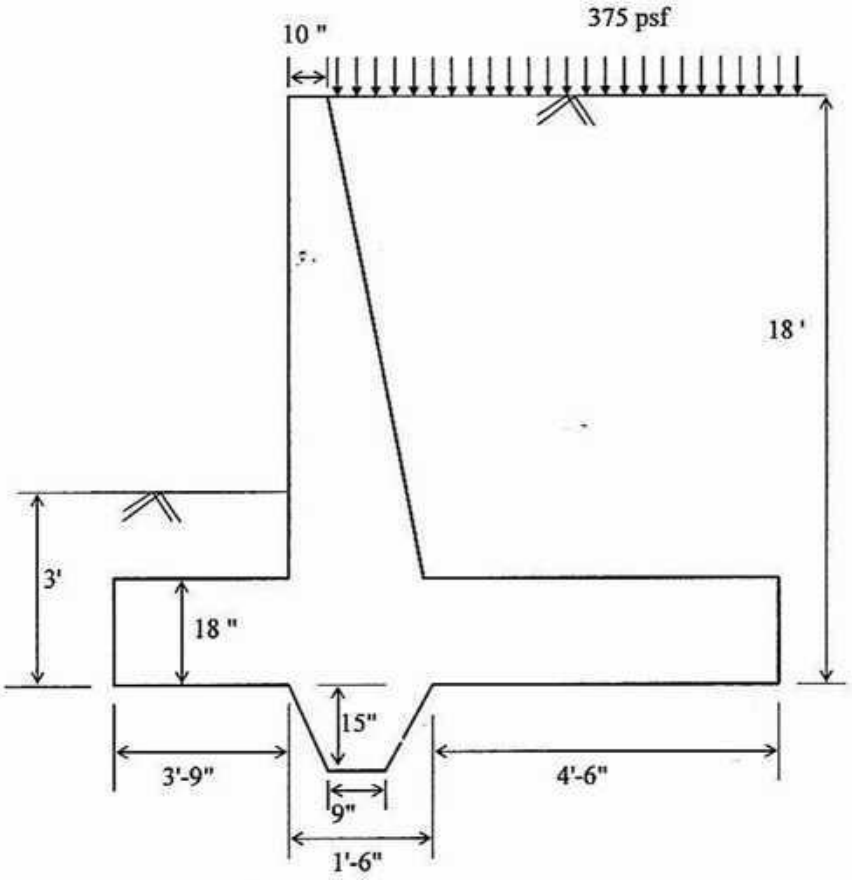


6.(b) A trial section of a cantilever retaining wall as shown in the following figure was planned to support the soil behind the wall and the surcharge on the ground surface. **(10)**

i) Check the external stability of the section against sliding and overturning.
ii) Also check the soil pressure under the base.

[Consider only the critical position of surcharge LL.]

Given: γ_s = 120 pcf, $\phi = 30^o$, f_{base} = 0.5, allowable bearing pressure = 6 ksf.



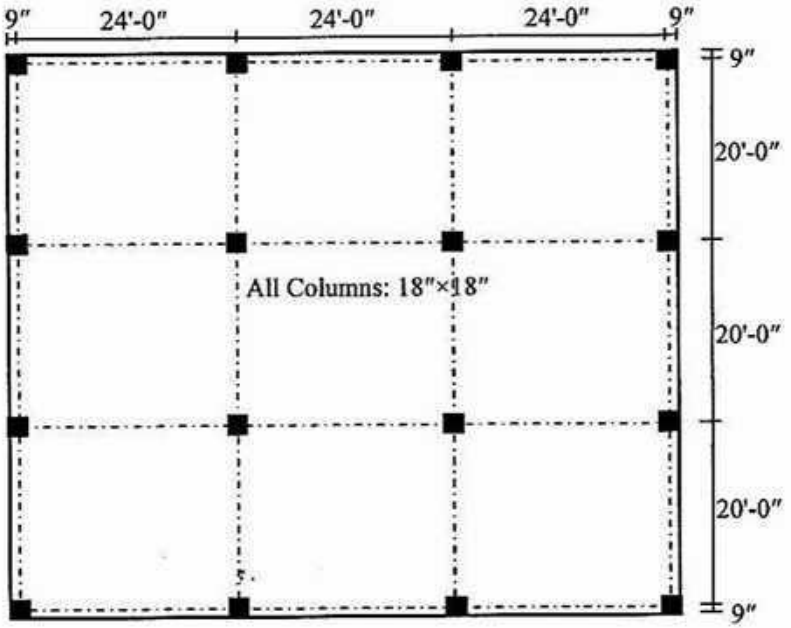
7.(a) An office building is planned using a flat plate floor system with the column layout as shown in the following figure. No beams, drop panels or column capitals are permitted. The columns are 18 inch square and floor to floor height of the building is 12.0 ft. Other design conditions and material properties are given below: **(20)**

FF=20 psf, Partition wall load = 30 psf and LL=60 psf

Design an interior panel by **WSD**.

Follow the steps mentioned below:

(i) Calculation for minimum slab thickness
(ii) Check for punching shear – around interior column
(iii) Calculation for design moments (in long directions only)
(iv) Check for slab thickness – moment consideration
(v) Calculation for flexural reinforcements (in long direction only)
(vi) Neat sketches for reinforcements (in long direction only)



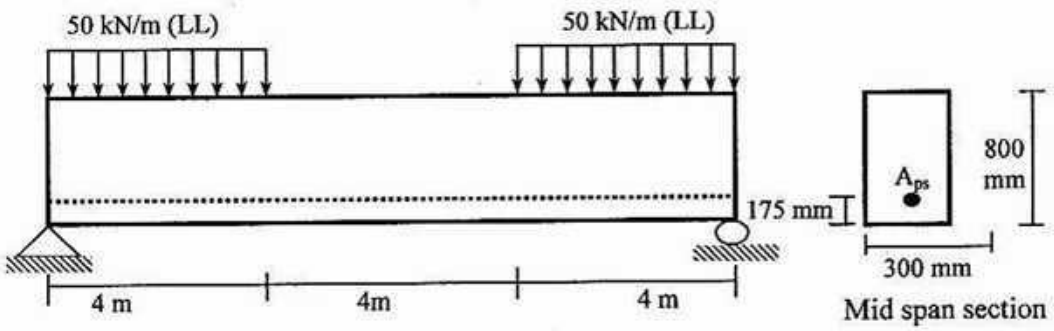
7.(b) Compare flat plate with flat slab. What are the functions of a drop panel in a column supported floor? **(05)**

8.(a) Mention the ACI specification for stress in concrete and steel for prestressed concrete during (i)Transfer of prestress (ii) Service condition. **(04)**

8.(b) Define i) Internal prestressing and External prestressing ii) Linear prestressing and Circular prestressing. **(05)**

8.(c) A pre-tensioned concrete beam has a prestress of 1580 kN in the steel immediately after prestressing and reduces to 1370 kN due to losses. In addition to live loads shown in the figure, it has a self weight of 5.76 kN/m. Compute the extreme fibre stresses at midspan for the following conditions: **(10)**

i) at initial condition with full prestress and no live load
ii) at working condition with effective prestress and full live loads.



8.(d) For the beam in Question 8(c) , compute the total load (dead and live) that can be carried by the beam for the following conditions: **(06)**

(i) zero tensile stress in the bottom fibre
(ii) cracking in the bottom fibres at a modulus of rupture of 4.2 MPa, and assuming concrete will take tension up to that value only.

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

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

Answer any five questions out of six. Question no. 3 is compulsory.
(Note: Assume any missing data)

1. (a) State Darcy's law. (3)

   (b) Briefly explain the groundwater sources. Also discuss the problems in groundwater development in Bangladesh. (6)

   (c) Differentiate between aquifuge, aquitard, aquiclude & aquifer. (4)

   (d) Design the transmission main and the pumping unit from the following data: (7)

   Water supply rate = 40 gpcd
   Estimation population = 85,000
   Ground R.L. = at the pump house = 102.50 ft.
   Treatment plant R.L.= 193.00 ft
   Velocity through pipes = 8 fps
   Pumping time = 10 hrs. daily
   Total length of pipe = 3500 ft.
   Friction factor = 0.01
   Efficiency = 65%

2. (a) Briefly explain the importance of interference of wells. Also discuss the remedy of this problem including all related equations. (5)

   (b) What are the reasons for failure of tube wells ? (2)

   (c) Design a tube well of a suitable aquifer for extracting drinking water at a depth from 220 ft to 320 ft. (13)
   (Summary of grain size test report and the gradation chart is given in the attached sheet).

3. (a) Define intake structures. Discuss any two types of intake structures. (6)

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

   (c) How can you reduce the water- hammer effect in water work practices ? (3)

(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)

a. The closure time is 2 sec
b. The closure time is 6 sec

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

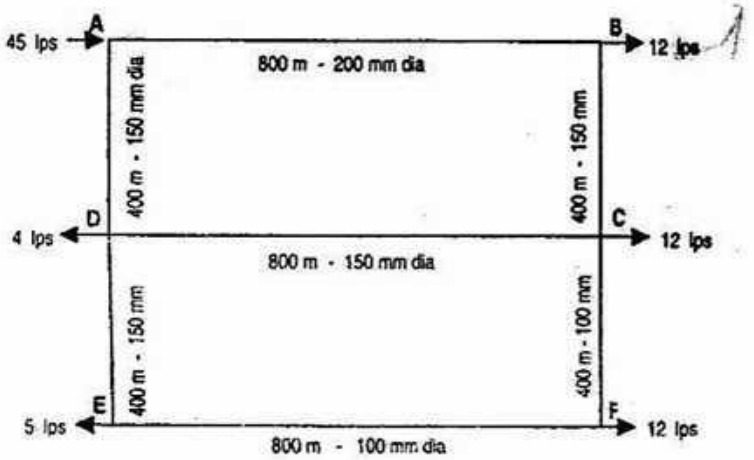
4. (a) Write down the principles of iron removal technology and also discuss the process of iron removal technology used in Bangladesh. (12)

(b) Briefly explain the theories of filtration. (3)

(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. (5)

5. (a) What are the main purposes of the construction of water transmission and distribution pipe-lines ? (4)

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



6. (a) What are the advantage and disadvantage in rainfall harvesting in Bangladesh ? (6)

(b) Find the diameter of a settling tank to treat 45 m^3 of raw water per hour when the overflow rate is 0.5 m/hr and the detention time is 3 hours. (5)

(c) Explain any three of the following: (3X3)

i. Coagulation and flocculation
ii. Disinfection
iii. Water use and reuse
iv. Ethics of water

v. Water pricing

Note:

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. $T_C = 2S/U_P$

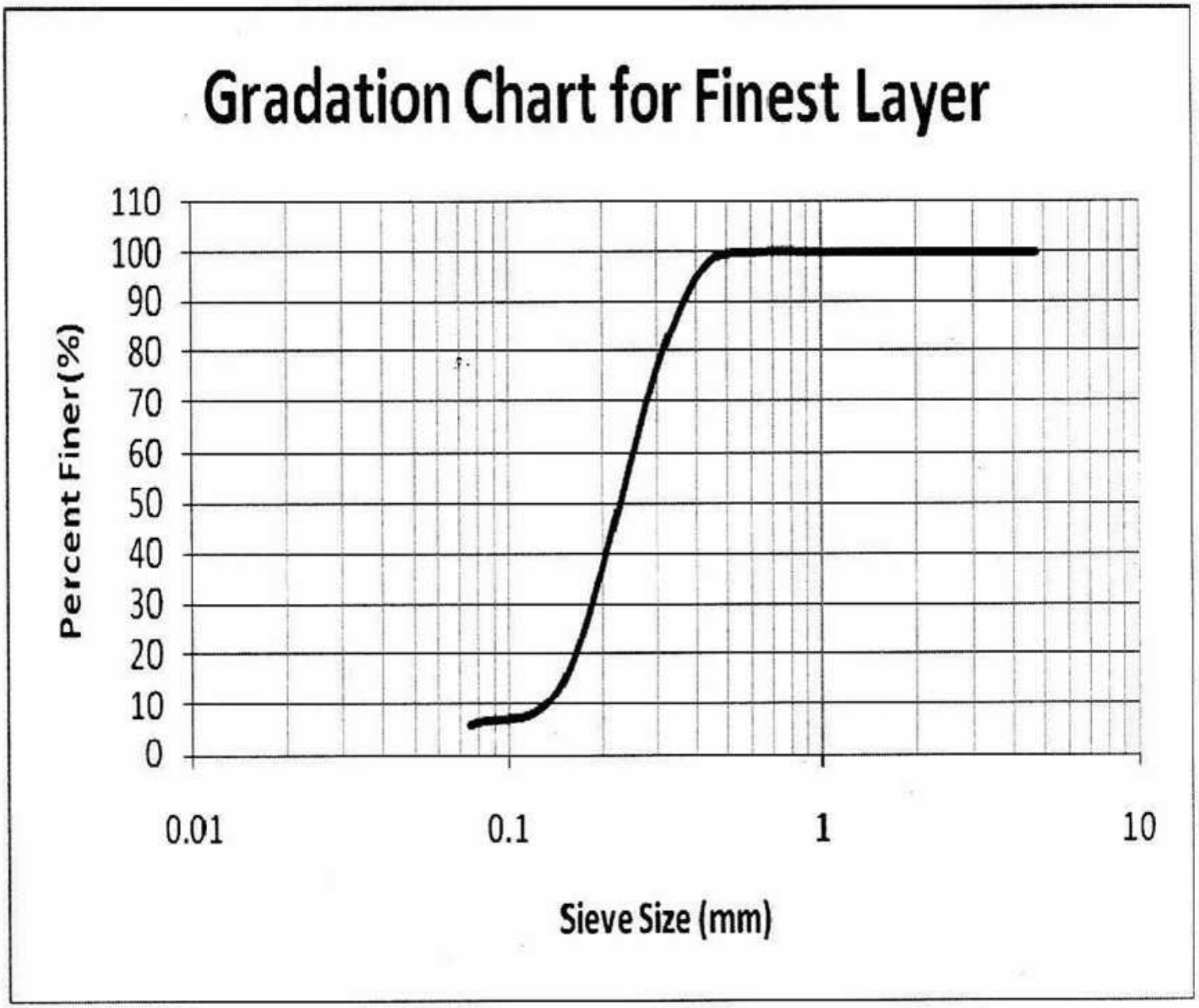
4. $\Delta = -\sum H /(x \sum H/ Q_a)$

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:

Serial No.	Depth (ft)	FM	D_{60} (mm)	D_{10} (mm)	Uniformity Coefficient, U
1	220-230	1.59	0.35	0.18	1.94
2	230-240	1.50	0.34	0.165	2.06
3	240-250	1.59	0.35	0.185	1.89
4	250-260	1.61	0.35	0.175	2.00
5	260-270	1.62	0.35	0.185	1.89
6	270-280	1.54	0.345	0.17	2.03
7	280-290	1.71	0.38	0.20	1.90
8	290-300	1.08	0.245	0.125	1.96
9	300-310	1.41	0.32	0.16	2.00
10	310-320	1.23	0.27	0.15	1.80

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



University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B.Sc. Engineering (Civil)

Course Title: Geotechnical Engineering I — Course Code: CE 341
Time: 3 hours — Full Marks: 100

Section A
There are four questions. Answer any 3 questions. (3x16=48 marks)

1. a) Define: (i) Void ratio (ii) Degree of saturation (iii) Optimum Moisture Content 6
b) How can you identify an organic soil? 2
c) A soil sample was taken from a 12 ft thick clay layer, lying between a sand and an impervious layers. After how many days would this layer reach 50% consolidation? In a laboratory consolidation test, a sample of clay with a thickness of 1 inch reached 50% consolidation in 10 minutes. 8

2. a) Derive the relationship: $S \cdot e = w \cdot G_s$ 6
b) Calculate the primary consolidation settlement of a saturated clay layer under a surcharge pressure of 150 kN/m^2. The overburden pressure (σ) at the middle of the clay layer is 80 kN/m^2. The clay layer is 4m thick. Given that, liquid limit of the clayey soil is 30%. The preconsolidation pressure is 190 kN/m^2. Initial void ratio, e_0 is 0.6. Assume, $C_s \sim 0.2C_c$. 10

3. a) Define: (i) Hydraulic conductivity (ii) Piezometric level (iii) Coefficient of permeability 6
b) Discuss on the factors influencing permeability of soil. 4
c) Draw three-phase diagrams of soil agreegates for dry, moist and saturated conditions. 6

4. a) How can you estimate (calculate) hydraulic conductivity without conducting a permeability test? 3
b) Draw compaction curves for moderately plastic soil, highly plastic soil and non-plastic soil. 3
c) Write short notes on: (i) Relative density, (ii) Zero Air Void Line, and
(iii) Modified Proctor Test 6
d) Calculate the overconsolidation ratio of a soil element 10 m from the ground level. Saturated and unsaturated unit weights of the soil are 18 kN/m^3 and 20 kN/m^3. Groundwater table is at 3 m from the ground surface. The soil experiences a maximum of 200 kN/m^2 effective stress in its history. 4

Section B
There are five questions. Answer any 4 questions. (4x13 = 52 marks)

5. A consoliated undrained test was conducted on a clay sample and the following results we obtained. 13

Cell pressure (kN/m^2)	200	400	600
Deviator stress (kN/m^2)	118	240	352
Pore water pressure (kN/m^2)	110	220	320

Determine the shear strength parameters with respect to (i) total stresses and (ii) effective stresses.

6. A direct shear test was carried out on a cohesive soil sample and the following results were obtained. 13

Normal Stress (kN/m^2)	150	250
Shear stress at failure (kN/m^2)	110	120

Evaluate the shear strength parameters. What would be the deviator stress at failure if a triaxial test is carried out on the same soil with cell pressure of 150 kN/m^2.

7. a) Derive the following expression: $k_a = \tan^2(45 - \varphi/2)$, where k_a and φ denote active earth pressure and angle of internal friction, respectively. 7

b) Evaluate the coefficient of earth pressure at rest for overconsolidated soil ($k_{0(overconsolidated)}$). The overconsolidation ratio (OCR) is 6. At normally consolidated condition, the coefficient of earth pressure at rest was 0.3. Also, evaluate the angle of internal friction (φ). 3

c) Define the coefficients of lateral earth pressure (k_0, k_a and k_p). 3

8. a) Classify the soil using Unified Soil Classification System. Classification tests were done on a soil sample and the following results were obtained. 8

Grain size test results

% finer than 4.75 mm = 96

% finer than 2 mm = 60

% finer than 0.425 mm = 30

% finer than 0.075 = 10

Consistency test results of soil fraction finer than 0.425 mm

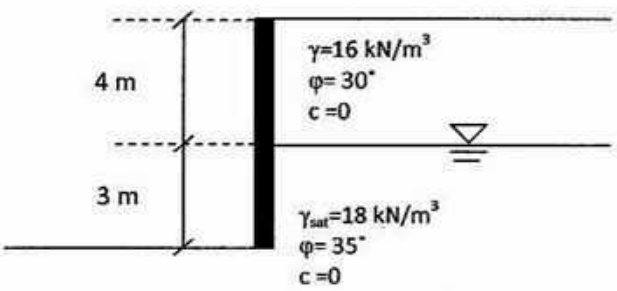
Liquid limit (%) = 40

Plastic limit (%) = 20

b) According to Unified Soil Classification System, a soil is classified as CL-ML. Mention the ranges of liquid limit, plastic limit and plasticity index of the soil. 5

9. a) Define: (i) Plasticity Index, (ii) Effective size 3

b) For the retaining wall shown in the following figure, determine the active force per unit width of the wall for Rankine state. Also find the location of the resultant. 10



University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 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 4 out of 5 questions:

1. Imagine that you have been sent to the field to conduct a spot speed study. Generate a hypothetical dataset with speed of the vehicles between 32 and 64 miles/hr. Draw the frequency and cumulative frequency distribution curves and calculate the common descriptive statistics (e.g., mean speed, pace, etc.) 37.5

2. You have been asked to conduct a traffic volume study for an imaginary location in Dhaka city. Your client has given you more than enough budget to conduct a 1-day volume count. However, it is not sufficient for a 6-day volume count. You have decided to collect data for 3 days. Generate hypothetical data and mathematically demonstrate how you will conduct the study. Also specify how many people will be needed for your study. 37.5

3. Draw the graphs to present the typical speed-flow-density relationships. Assume that a speed-density study has resulted in the following calibrated relationship: 37.5

$$S = 55.0 - 0.45D$$

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

4. Explain with mathematical examples: 37.5
(a) Trip distribution (Gravity Model)
(b) Mode choice

5. Answer all:
(a) What is PCE? Give a mathematical example to demonstrate its use in traffic engineering. 12.5
(b) 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
(c) Draw a spiral curve and show its different elements. 10

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program : B.Sc. Engineering (Civil)

Course Title: Open Channel Flow **Course Code: CE 361**
Time: 3 Hrs **Full Marks: 120**

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

1.	(a)	Define Normal depth; Section factor and Conveyance of an open channel.	6
	(b)	Write down the various uniform flow formulae	6
	(c)	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.	8
2.	(a)	Define hydraulic jump. Draw schematic diagram and show initial and final jump, length of the jump and height of jump.	6
	(b)	Classify the hydraulic jumps based on Froud number.	6
	(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.	8
3.	(a)	Define Sequent depth and establish the sequent depth formula for a horizontal rectangular channel.	8
	(b)	Define freeboard and lining.	4
	(c)	Write down design steps for a lined trapezoidal channel with appropriate figure.	8
4.	(a)	What is flow measurement device? What are the criteria on which the choice of construction material depends?	6
	(b)	Draw a schematic diagram of a broad crested weir and state the conditions to be satisfied to exist the hydrostatic pressure distribution.	6
	(c)	Derive the discharge formula for broad crested weir for free flow condition.	8
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.	8
	(b)	What are the differences between sharp crested and broad crested weirs?	5
	(c)	Obtain the relationship among Chezy's **C**, Darcy-Weishbach friction factor **f** and Manning's **n**.	7
6.	(a)	Draw a schematic diagram of a Parshall flume. What are the advantages of flumes over the weirs?	5
	(b)	Determine the discharge through a **4** ft Parshall flume if the depth measured upstream is **1.25** m under free flow condition.	5
	(c)	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.	10
7.	(a)	What are the conditions for establishing uniform flow in an open channel?	6
	(b)	Define 'Specific force' and 'Regime' approach of an open channel.	6
	(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.	8
8.	(a)	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.	10
	(b)	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**.	5
	(c)	What are the various factors affecting the Manning's roughness coefficient, **n**	5

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B.Sc Engineering (Civil)

Course Title: Engineering Hydrology | Course Code: CE 363
Time: 3.00 hours | Full Marks: 150

Part A
Answer any Three

1. **(a)** Write short notes on (any three): (9)
   i. Infiltration capacity
   ii. WMO guideline for evaporation station
   iii. Climate of Bangladesh
   iv. Depth - Duration – Frequency curve

   (b) Distinguish between the following (any three): (6)
   i. Recording and non-recording raingauges
   ii. Cold and warm fronts
   iii. Field capacity and permanent wilting point
   iv. Storm hydrograph and Direct runoff hydrograph

   (c) Test of the consistency of 12 years data of the annual precipitation are measured at station **A**. Rainfall data for station **A** as well as the average annual rainfall measured at a group of eight neighboring stations located in a meteorologically homogeneous region are given below. (10)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Station A (cm)	122	112	115	127	150	130	200	170	145	123	140	150
8 Station Average (cm)	61	56	57.5	63.5	75	65	100	85	131	111	126	135

   i. In what year a change in regime is indicated?
   ii. Adjust the recorded data at station **A** and determine the mean annual precipitation.

2. **(a)** How do you determine the Precipitable Water in a saturated air column? (8)

   (b) There are four raingauge stations in and around a catchment whose shape can be described by joining points through straight line of the following coordinates (distance in km): (0,0), (16,8), (32,0), (24,16), (32,32), (16,24), (0,32), (8,16), (0,0). Coordinates of raingauge stations are (12,12), (12,20), (20,12), (20,20) and the annual rainfall recorded are 150, 75, 175 and 200mm respectively. Find the mean precipitation for the given catchment by thiessen polygon method. (17)

3. **(a)** Estimate the daily potential evapotranspiration from the following data using Penman's formula: (10)
   i. Slope of the saturation vapor pressure vs. temperature at the mean air temperature = 1.24 mm/°C
   ii. Relative humidity = 80%
   iii. Wind velocity at 5.0m height = 110km/day

iv. Net radiation = 5.0mm of water per day

v. Psychrometric constant = 0.49 mm of Hg/°C

Table is given in attachment.

(b) Discuss Energy budget method of estimating evaporation from lake with neat sketch. (5)

(c) A reservoir had an average area of 2000ha. In a particular month the mean rate of inflow = $15m^3/s$, outflow = $10m^3/s$, monthly rainfall = 10cm and increase in storage = $12Mm^3$. Assuming the seepage losses to be 1.8cm, estimate the evaporation in that month. (10)

4. **(a)** Explain the various commonly used methods of measurement of stage of a river. (6)

(b) Explain the procedure for supplementing the missing rainfall data. (4)

(c) The following are the data obtained in a stream-gauging operation of River (A) by using a current meter which is not calibrated. For this reason, you have collected another set of data from a stream whose velocity is known. Now calculate the discharge of River (A) using mid-section method? (15)

Data collected from the Stream of Known velocity			
Distance from left bank (m)	Current Meter Reading		
	Rev.	Sec	Velocity
0	0	0	---
5	80	80	0.250
10	180	100	0.450
15	300	100	0.750
20	240	100	0.600
25	75	50	0.375
30	0	0	---

Data Collected from **River (A)**			
Distance from left bank (m)	Depth, d (m)	Current Meter Reading	
		Revolutions	Time (sec)
0	0	0	0
3	1.3	40	100
6	1.75	58	100
10	2.5	120	150
14	2	90	100
17	1.6	50	100
20	0	0	0

Part B

Answer any Three

5. **(a)** With the help of typical hydrograph describe the salient features of (i) perennial (ii) intermittent and (iii) ephemeral streams. (6)

(b) Ordinates of a 6-h unit hydrograph are given. Using this derive a 3-h unit hydrograph for the same catchment (use S-curve method). (16)

Time (h)	0	6	12	18	24	30	36	42	48	54
Ordinates of 6-h unit hydrograph	0.00	69.00	117.00	131.00	120.00	92.00	57.00	23.00	8.00	0.00

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

6. (a) Rainfall of magnitude 10cm in 2-h duration on a catchment area of 192km^2 produced the following hydrograph of flow at the outlet of the catchment. Estimate the rainfall excess and Φ index. (10)

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66	72
Observed Flow (m^3/sec)	10	35	135	190	165	110	70	40	28	22	17	13	10

(b) Derive a 6-h unit hydrograph from the previous question. 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 15m^3/sec. (15)

7. (a) The inflow and out flow hydrographs for a reach of a river are given below. Determine the best values of Muskingum coefficients k and x for the reach. (16)

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66	72
Inflow (cumec)	5	18	68	95	83	55	35	20	14	11	9	7	5
Outflow (cumec)	5	9	30	70	91	79	52	30	20	12	10	8	5.5

(b) Describe a method of reservoir routing. (5)

(c) What are the factors affecting shape of a flood hydrograph? (4)

8. (a) The following table gives the observed annual flood values in the river Buriganga. Estimate the flood peaks with return period of 50 and 100 years using Gumbel's distribution. (15)

Year	1987	1988	1989	1990	1991	1992	1993	1994
Flood Flow (m^3/sec)	5778	9000	2250	5940	4464	3204	3348	8460
Year	1995	1996	1997	1998	1999	2000		
Flood Flow (m^3/sec)	5598	4176	4335	6849	3276	2826		

(b) What are the 85% confidence limits for the estimated flood peaks in 8(a)? (10)

Table of normal variates:

C in percent	50	80	90	95
f(c)	0.674	1.282	1.645	1.96

Attachment

TABLE SATURATION VAPOUR PRESSURE OF WATER

Temperature (°C)	Saturation vapour pressure e_w (mm of Hg)	A (mm/°C)
0	4.58	0.30
5.0	6.54	0.45
7.5	7.78	0.54
10.0	9.21	0.60
12.5	10.87	0.71
15.0	12.79	0.80
17.5	15.00	0.95
20.0	17.54	1.05
22.5	20.44	1.24
25.0	23.76	1.40
27.5	27.54	1.61
30.0	31.82	1.85
32.5	36.68	2.07
35.0	42.81	2.35
37.5	48.36	2.62
40.0	55.32	2.95
45.0	71.20	3.66

$$e_w = 4.584 \exp\left(\frac{17.27\,t}{237.3 + t}\right) \text{mm of Hg, where } t = \text{temperature in °C}$$

TABLE 7.3 REDUCED MEAN $\bar{y}_n$ IN GUMBEL'S EXTREME VALUE DISTRIBUTION

N = sample size

N	0	1	2	3	4	5	6	7	8	9
10	0.4952	0.4996	0.5035	0.5070	0.5100	0.5128	0.5157	0.5181	0.5202	0.5220
20	0.5236	0.5252	0.5268	0.5283	0.5296	0.5309	0.5320	0.5332	0.5343	0.5353
30	0.5362	0.5371	0.5380	0.5388	0.5396	0.5402	0.5410	0.5418	0.5424	0.5430
40	0.5436	0.5442	0.5448	0.5453	0.5458	0.5463	0.5468	0.5473	0.5477	0.5481
50	0.5485	0.5489	0.5493	0.5497	0.5501	0.5504	0.5508	0.5511	0.5515	0.5518
60	0.5521	0.5524	0.5527	0.5530	0.5533	0.5535	0.5538	0.5540	0.5543	0.5545
70	0.5548	0.5550	0.5552	0.5555	0.5557	0.5559	0.5561	0.5563	0.5565	0.5567
80	0.5569	0.5570	0.5572	0.5574	0.5576	0.5578	0.5580	0.5581	0.5583	0.5585
90	0.5586	0.5587	0.5589	0.5591	0.5592	0.5593	0.5595	0.5596	0.5598	0.5599
100	0.5600									

TABLE 7.4 REDUCED STANDARD DEVIATION S_n IN GUMBEL'S EXTREME VALUE DISTRIBUTION

N = sample size

N	0	1	2	3	4	5	6	7	8	9
10	0.9496	0.9676	0.9833	0.9971	1.0095	1.0206	1.0316	1.0411	1.0493	1.0565
20	1.0628	1.0696	1.0754	1.0811	1.0864	1.0915	1.0961	1.1004	1.1047	1.1086
30	1.1124	1.1159	1.1193	1.1226	1.1255	1.1285	1.1313	1.1339	1.1363	1.1388
40	1.1413	1.1436	1.1458	1.1480	1.1499	1.1519	1.1538	1.1557	1.1574	1.1590
50	1.1607	1.1623	1.1638	1.1658	1.1667	1.1681	1.1696	1.1708	1.1721	1.1734
60	1.1747	1.1759	1.1770	1.1782	1.1793	1.1803	1.1814	1.1824	1.1834	1.1844
70	1.1854	1.1863	1.1873	1.1881	1.1890	1.1898	1.1906	1.1915	1.1923	1.1930
80	1.1938	1.1945	1.1953	1.1959	1.1967	1.1973	1.1980	1.1987	1.1994	1.2001
90	1.2007	1.2013	1.2020	1.2026	1.2032	1.2038	1.2044	1.2049	1.2055	1.2060
100	1.2065									

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Project Planning and Management | Course Code: CE 401
Time: 3 hrs | Full Marks: 125

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

1. (a) What do you understand by Inflation of money? [7]
How does it affect in the financial evaluation of a project.

(b) The Farmer's American Bank of Leesburg is planning to install a new computerized accounts system. Bank management has determined the activities required to complete the project. [18]

The precedence relationships of the activities are as follows:

Activity	Activity Predecessor	Time (Weeks)
1	-------	3
2	1	2
3	1	5
4	1	4
5	2	3
6	3	2
7	4	8
8	5, 6	4
9	8	4
10	7	4
11	9, 10	7

(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 activity
(v) If you reduce the time required for activity 8 and 10 by 1 week each, find the project completion time and critical path as well.

2. (a) The following tabulations are actual sales of units for six months and a starting forecast in January. [15]

(i) Calculate the forecast for the remaining five months using simple exponential smoothing with $\alpha = 0.2$.

(ii) Find forecasted value for the last three months using 3 quarter moving weighted average method (assign 2.5 times more weight for the most recent data compared to the oldest data and 1.5 times more weight for the second recent data compared to the oldest data).

(iii) Using MAD, find the appropriate forecast method among the above two.
Justify your answer.

(b) Discuss Regression Analysis of Forecasting in detail.
In which case it is applicable? Justify your answer. [10]

3. (a) The are following five jobs must pass through Machine1 and Machine2 sequentially. Operating times for both machines are shown below for each job [13]

Job	Operations Time for Machine 1	Operations Time for Machine 2
A	6	3
B	0	4
C	5	2
D	8	6
E	2	1

(i) Schedule the five jobs through two machines in sequence (i.e., show job sequence and show the arrangement in diagram for Machine 1 and 2) to minimize the flow time using Johnson's rule.

(ii) Find the job completion time.

(iii) Find the slack time or idle time for machine 1 and 2, separately.

(b) Should IRR be higher than discount rate for accepting a project? Justify. [6]

(c) Why is Lesson learnt important for project implementation? Explain. [6]

4. (a) Assign the following tasks (1 to 4) to the employees (A to B) such that each employee will be assigned by only one task to minimize the total cost. [13]

Find at least two multiple solutions if there is any.

Tasks

Employees	1	2	3	4
A	5	7	11	6
B	8	5	9	6
C	4	7	10	7
D	10	4	8	3

(b) A firm can produce three types of cloth, A, B and C. [12]
Three kinds of wool, red wool, green wool and blue wool are required for it.

One unit length of Type A cloth needs 2 yards of red wool and 3 yards of blue wool; one unit length of type B cloth needs 3 yards of red wool, 2 yards of green wool and 2 yards of blue wool; and one unit length of type C cloth needs 5 yards of green wool and 4 yards of blue wool.

It is assumed that the income obtained from one unit length of type A cloth is Tk. 3, of type B Tk. 5 and that of type C cloth is Tk. 4.

The firm has a stock of 8 yards of red wool, 10 yards of green wool and 15 yards of blue wool.

Formulate the problem as a linear programming problem.

5. (a) Objective function: [20]

Maximize $Z = 5x_1 + 4x_2$

Constraints:

$6x_1 + 4x_2 \leq 24$

$x_2 \leq 2$

$x_1 + 2x_2 \leq 6$

$-x_1 + x_2 \leq 1$

$x_1, x_2 \geq 0$

(i) Find the feasible area by Graphical Method

(ii) Find the optimum value of x_1 and x_2.

(iii) Find the maximum profit

(iv) Find the range of optimality for x_1 and x_2 separately.

(b) Write the possible limitations of graphical method of LP. [5]

6. (a) Solve the LP problem by Simplex method [22]

Objective function:

Maximize $Z = 2x_1 - 4x_2 + 5x_3 - 6x_4$

Constraints:

$x_1 + 4x_2 - 2x_3 + 8x_4 \leq 2$

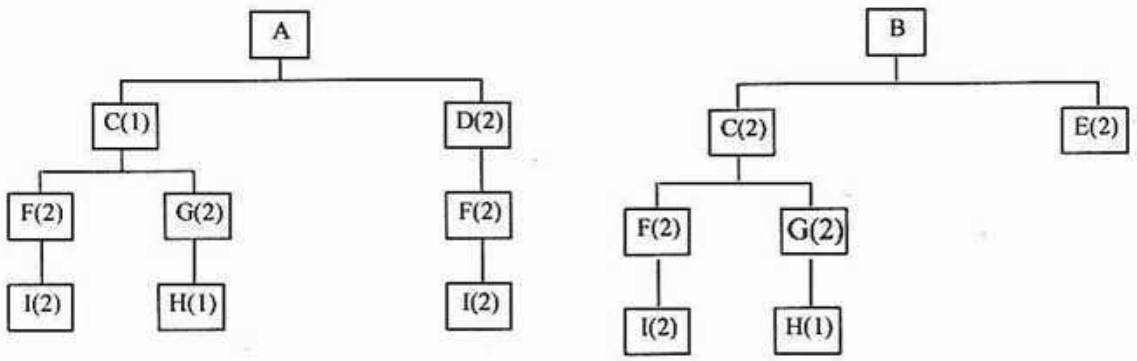
$-x_1 + 2x_2 + 3x_3 + 4x_4 \leq 1$

$x_1, x_2, x_3, x_4 \geq 0$

(b) What are the benefits of Gantt Chart? Discuss. [3]

7. Brown and Brown Electronics manufactures a line of digital audiotape (DAT) players. While there are differences among the various products, there are a number of common parts within each player. [25]

The bill of materials, showing the number of each item required, lead times and the current inventory on hand for the parts and components, follows:



Demand of products A and B and demand of spare components are shown below

Item	Demand on 9th week	Demand on 7th week	On-Hand	Lead Time (Weeks)
A	700	-----	30	1
B	1200	-----	50	2
C	-----	270	75	1
D	320	300	80	2
E	-----	380	100	1
F	300	100	150	1
G	-----	400	40	1
H	-----	-----	200	1
I	-----	-----	300	1

Prepare a MRP schedule to satisfy demand (Use the supplied sheet)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Professional Practices and Communication — Course Code: CE 403
Time: 120 minutes — Full Marks: (10 × 10 =) 100

Answer **any 10 (ten)** of the following 12 questions

1. a) What is Contract? [1]
   b) What are the essential elements of a contract? [3]
   c) What are the advantages and disadvantages of Admeasurement and Cost/Reimbursement contracts? [6]

2. a) State the ways in which the Public Procurement regulations shall improve public procurement in Bangladesh. [3]
   b) Mention the tasks for preparation and submission of tender. [7]

3. a) Draw the flow diagram of preparation and approval procedures of DPP. [5]
   b) Explain the sequence of the above-mentioned flow diagram [5]

4. a) What are different methods of procurement? [2]
   b) Explain all the methods of procurement. [8]

5. a) What are included in a Standard Tender Document? [7]
   b) Contract price of stone aggregate is Tk. 130, its price at the time of execution (as per BBS) is Tk. 145 and the price 28 days before receiving tenders was Tk. 138. What will be the adjusted unit price of that item? Use usual value of coefficient. [3]

6. a) What are the factors on which acquiring and maintaining ethical values depend? [3]
   b) Write down the fundamental canons of ethics. [7]

7. a) Define Industrial Relation. [1]
   b) Write down the importance of Industrial Relation. [9]

8. a) What is unemployment? [1]
   b) Explain through equation that "steady state rate of employment 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 [9]

9. Explain five steps in preparing effective business messages. [10]

10. Write down all elements of a typical meeting minute following the sequence as narrated in the class and explain each element. [10]

11. 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]

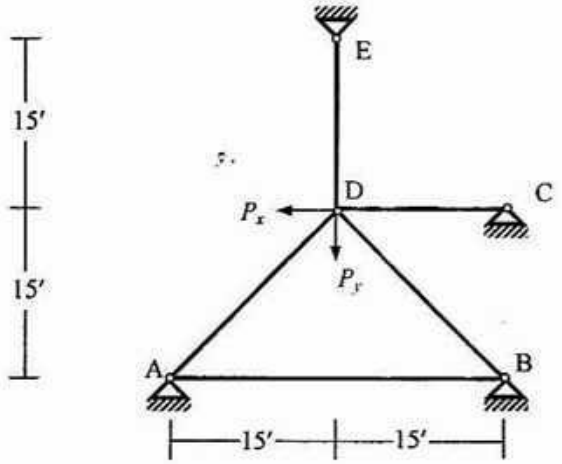
12. a) What are the functions of ECNEC? [6]
    b) What is arbitration? [1]
    c) Why is arbitration preferable? [3]

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
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)

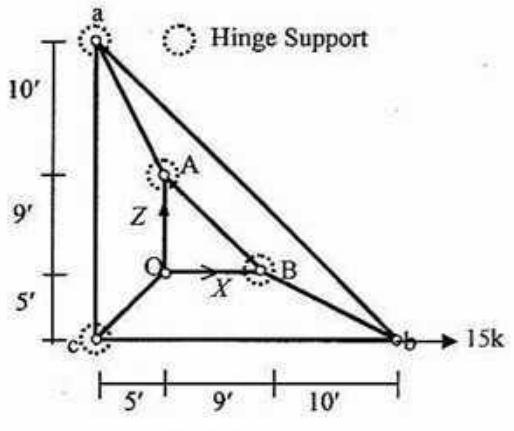
[Answer **any 09 (nine)** of the following 13 questions]

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].

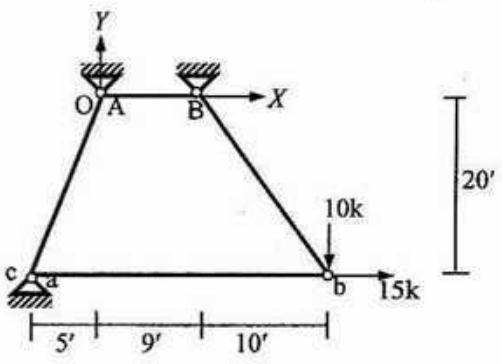


2. For the truss described in Question 1, the joint D moves 0.15′ vertically (downward) and 0.15′ horizontally (leftward) under the action of the given loads. Calculate all the member forces, support reactions and the applied external forces P_x and P_y.

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].



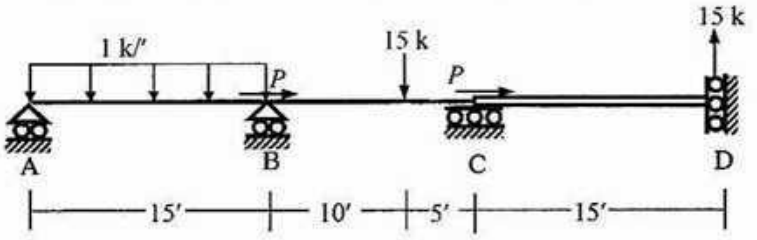
Top View



Front View

Nodal Coordinates (in ft)
O (0, 0, 0), A (0, 0, 9), B (9,0,0), a (–5, –20, 19), b (19, –20, –5), c (–5, -20, –5)

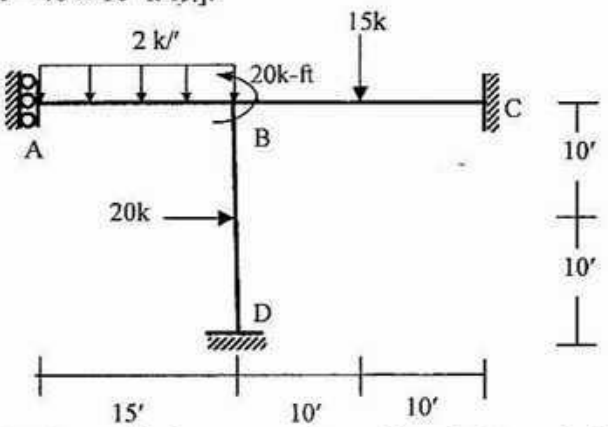
4. Determine the size of stiffness matrix (considering boundary conditions also) of the beam shown below. Also determine the size of its stiffness matrix if axial deformations are neglected. Use the stiffness method (neglecting axial deformations) to calculate the joint rotations and deflections of the beam loaded as shown below [Given: $P = 0$, $EI_{ABC} = 40\times10^3$ k-ft^2, $EI_{CD} = 80\times10^3$ k-ft^2].



C and D are Guided Rollers

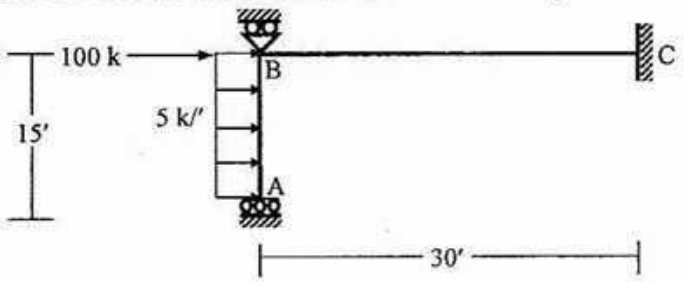
5. Use the Stiffness Method to calculate the forces P needed to cause buckling of the beam ABCD shown in Question 4, considering flexural deformations only with geometric nonlinearity.

6. Use the Stiffness Method to calculate the rotation at joint B and deflection at A of the frame ABCD loaded as shown below, considering flexural deformations only. Also calculate the joint moments [Given: EI = constant = 40×10^3 k-ft^2].



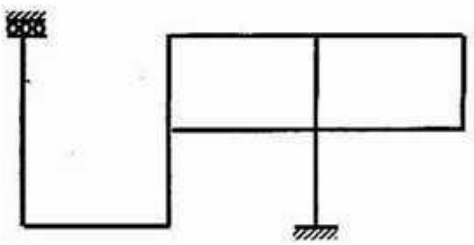
A is a Guided Roller

7. Use the Stiffness Method (considering geometric nonlinearity) to calculate the horizontal deflection at A and rotation at B of the frame loaded as shown below [Given: EI = constant = 20×10^3 k-ft^2].

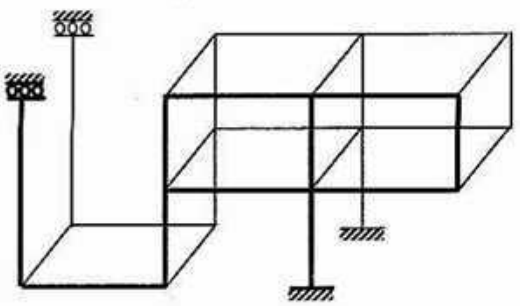


A is a Guided Roller

8. Determine the size of the stiffness matrices (with and without considering boundary conditions) of the 2D and 3D frame shown below. Also determine the size of the stiffness matrices if axial deformations are neglected.



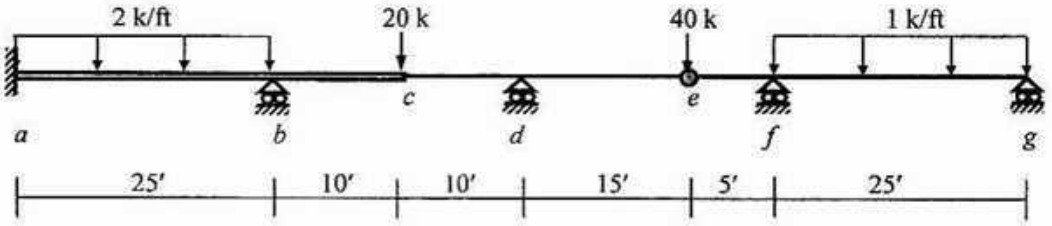
2D Frame



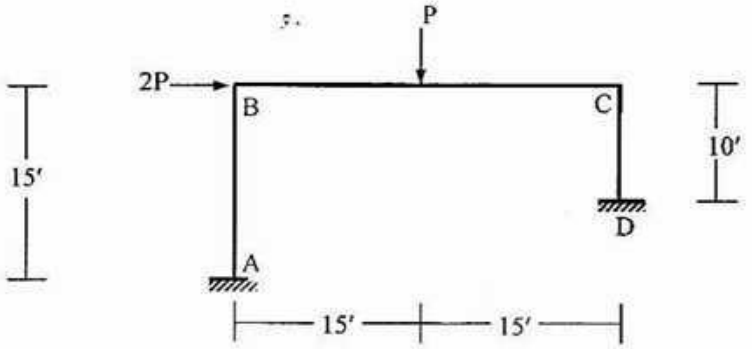
3D Frame

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

e is an Internal Hinge



10. Use the Energy Method to calculate the load (i) P needed to form beam mechanism, (ii) P needed to form the sidesway mechanism in the frames ABCD loaded as shown below [Given: $M_{pb} \neq M_{pc}$].



11. Use the consistent-mass matrix (considering flexural deformations only) to calculate the natural frequencies of the beam ABCD described in Question 4, if it weighs 0.20 k/ft.

12. For the truss shown in Question 1, 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].

13. Briefly explain
    (i) the difference between the stiffness matrices of a 2D beam member (without axial deformations) and a 2D Truss member although they are of the same size
    (ii) (in terms of stiffness matrix) why a structure becomes unstable at buckling load
    (iii) the possible causes of nonlinearity in structural analysis
    (iv) the terms material nonlinearity, plastic moment and collapse mechanism
    (v) two methods to improve the value of buckling load of a structure.

List of Useful Formulae for CE 411

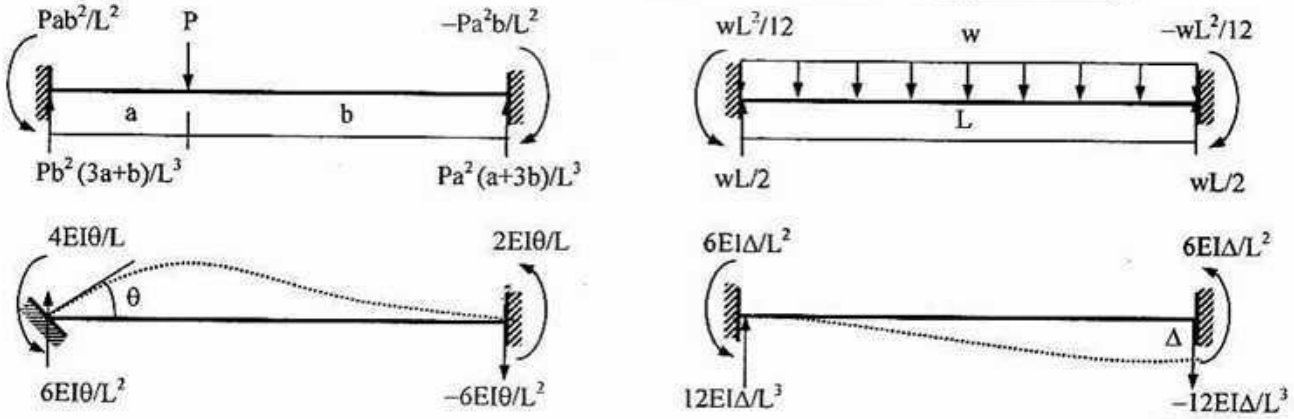
* The stiffness matrices $\mathbf{K_m}^L$ and $\mathbf{K_m}^G$ of axial member (e.g., 2D truss member) are given by

$$\mathbf{K_m}^L = \begin{pmatrix} S_x & 0 & -S_x & 0 \\ 0 & 0 & 0 & 0 \\ -S_x & 0 & S_x & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \qquad \mathbf{K_m}^G = S_x \begin{pmatrix} C^2 & CS & -C^2 & -CS \\ CS & S^2 & -CS & -S^2 \\ -C^2 & -CS & C^2 & CS \\ -CS & -S^2 & CS & S^2 \end{pmatrix}$$

Member force, $P_{AB} = S_x [(u_B - u_A) C + (v_B - v_A) S]$

[where $C = \cos\theta$, $S = \sin\theta$]

Fixed End Reactions for One-dimensional Prismatic Members under Typical Loadings



* The stiffness matrix of a 3D truss member in the global axes system [using $C_x = \cos\alpha$, $C_y = \cos\beta$, $C_z = \cos\gamma$] is

$$\mathbf{K_m}^G = S_x \begin{pmatrix} C_x^2 & C_xC_y & C_xC_z & -C_x^2 & -C_xC_y & -C_xC_z \\ C_yC_x & C_y^2 & C_yC_z & -C_yC_x & -C_y^2 & -C_yC_z \\ C_zC_x & C_zC_y & C_z^2 & -C_zC_x & -C_zC_y & -C_z^2 \\ -C_x^2 & -C_xC_y & -C_xC_z & C_x^2 & C_xC_y & C_xC_z \\ -C_yC_x & -C_y^2 & -C_yC_z & C_yC_x & C_y^2 & C_yC_z \\ -C_zC_x & -C_zC_y & -C_z^2 & C_zC_x & C_zC_y & C_z^2 \end{pmatrix}$$

$C_x = L_x/L$, $C_y = L_y/L$, $C_z = L_z/L$
where $L = \sqrt{[L_x^2 + L_y^2 + L_z^2]}$

* Member force $P_{AB} = S_x [(u_B - u_A) C_x + (v_B - v_A) C_y + (w_B - w_A) C_z]$
* Ignoring axial deformations, the matrices $\mathbf{K_m}^L$ and $\mathbf{G_m}^L$ of a frame member in the local axis system are

$$\mathbf{K_m}^L = \begin{pmatrix} S_1 & S_2 & -S_1 & S_2 \\ S_2 & S_3 & -S_2 & S_4 \\ -S_1 & -S_2 & S_1 & -S_2 \\ S_2 & S_4 & -S_2 & S_3 \end{pmatrix} \qquad \mathbf{G_m}^L = P/(30L) \begin{pmatrix} 36 & 3L & -36 & 3L \\ 3L & 4L^2 & -3L & -L^2 \\ -36 & -3L & 36 & -3L \\ 3L & -L^2 & -3L & 4L^2 \end{pmatrix}$$

$K_{ij} = \int EI\, \psi_i'' \psi_j'' \, dx$
$G_{ij} = \int P\, \psi_i' \psi_j' dx$

where $S_1 = 12EI/L^3$, $S_2 = 6EI/L^2$, $S_3 = 4EI/L$, $S_4 = 2EI/L$

* $\mathbf{K_{total}} = \mathbf{K} + \mathbf{G}$, buckling occurs (i.e., $P = P_{cr}$) when $|\mathbf{K_{total}}| = 0$
* For sections of Elastic-Fully-Plastic material (same f_y in tension and compression), $A_t = A_c = A/2$,
  $M_p = A_c\, \bar{y}_c + A_t\, \bar{y}_t = f_y\, (bh^2/4)$ for rectangular sections
* For RC sections, $M_p = A_s f_y (d - a/2)$, where $a = A_s f_y/(0.85 f_c' b)$
* Virtual work done by external forces (δW_E) = Virtual work done by internal forces (δW_I)
* For simply supported beams under (i) concentrated midspan load $P_u = 4 M_p/L$, and (ii) UDL $w_u = 8 M_p/L^2$
* For fixed-ended beams under (i) concentrated midspan load $P_u = 8 M_p/L$, and (ii) UDL $w_u = 16 M_p/L^2$
* For hinged-fixed ended beams under UDL $w_u = 11.66 M_p/L^2$
* Using CAA Method, $(m + c\Delta t/2 + k\Delta t^2/4)a_{i+1} = f_{i+1} - ku_i - (c + k\Delta t)v_i - (c\Delta t/2 + k\Delta t^2/4)a_i$
  [m = Total mass, c = Damping = $2\xi\sqrt{(km)}$, where ξ = Damping Ratio]
  Also $v_{i+1} = v_i + (a_i + a_{i+1})\Delta t/2$, and $u_{i+1} = u_i + v_i\, \Delta t + (a_i + a_{i+1})\Delta t^2/4$, starting with $a_0 = (f_0 - cv_0 - ku_0)/m$

* Lumped-Mass matrix [m_0 = Mass/length] Consistent-Mass matrix

Axial Member

$$\mathbf{M_m} = (m_0L/2) \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \qquad \mathbf{M_m} = (m_0L/3) \begin{pmatrix} 1 & 0.5 \\ 0.5 & 1 \end{pmatrix}$$

$M_{ij} = \int m_0 \phi_i \phi_j \, dx$

Flexural Member

$$\mathbf{M_m} = (m_0L/2) \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \qquad \mathbf{M_m} = (m_0L/420) \begin{pmatrix} 156 & 22L & 54 & -13L \\ 22L & 4L^2 & 13L & -3L^2 \\ 54 & 13L & 156 & -22L \\ -13L & -3L^2 & -22L & 4L^2 \end{pmatrix}$$

$M_{ij} = \int m_0 \psi_i \psi_j \, dx$

* At natural frequency (i.e., $\omega = \omega_n$), $|\mathbf{K} - \omega_n^2 \mathbf{M}| = 0$

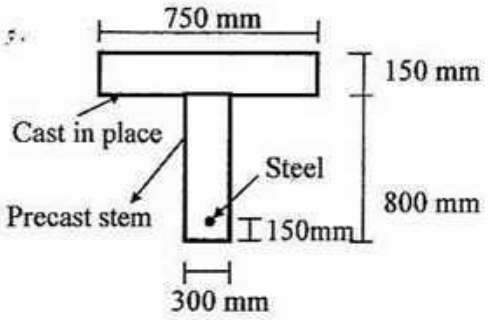
University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Structural Engineering V (Prestressed Concrete) Course Code: CE 415
Time: 2 Hours Full Marks: 100

[Answer any 5 (five) of the following 7 (seven) questions]
[Symbols carry their conventional meanings]

1) (a) The mid-span section of a **composite beam** is shown in the following Figure. The effective prestress is 1750 kN assuming the total loss as 15%. **Compute the stresses in the section at various stages** if the bending moment at the section is as follows: 16

- due to weight of precast stem= 350 kN-m
- due to top slab= 110 kN-m
- due to live load= 550 kN-m

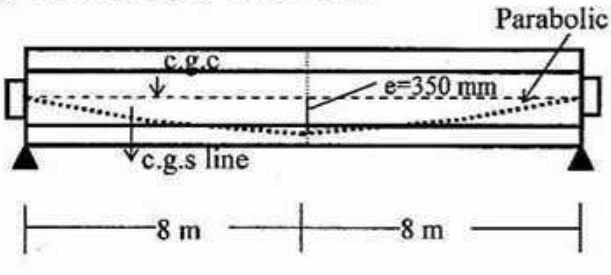


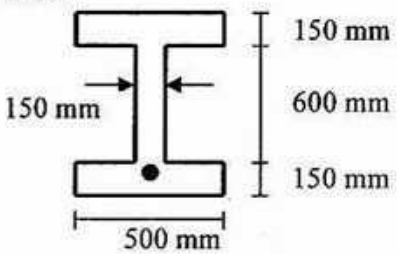
b) Explain stress distribution in concrete according to elastic theory. 04

2) a) The beam shown in the following figure carries a superimposed dead load of 6 kN/m and service live load of 1 kN/m in addition to its self weight. It has to carry a concentrated live load of 50 kN at mid-span.Assume that superimposed dead load are applied soon after prestress transfer.

Given: A_{ps}=1730 mm^2 , A_c=240×10^3 mm^2, I=2.408×10^{10} mm^4

f_{pi}=1300 MPa, f_{pe} =1120 MPa (after 15 years)
C_u=2.30, γ_{con}=24 kN/m^3
E_{ci}=25100 MPa, E_c=27400 MPa





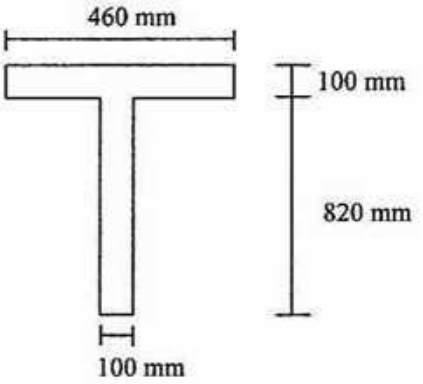
Mid span section

Calculate the mid-span deflection

I. Immediately at transfer of prestress and **II.** after 15 years. 16

b) Show the desirable layouts for two simple pretensioned and two simple post tensioned beams. 04

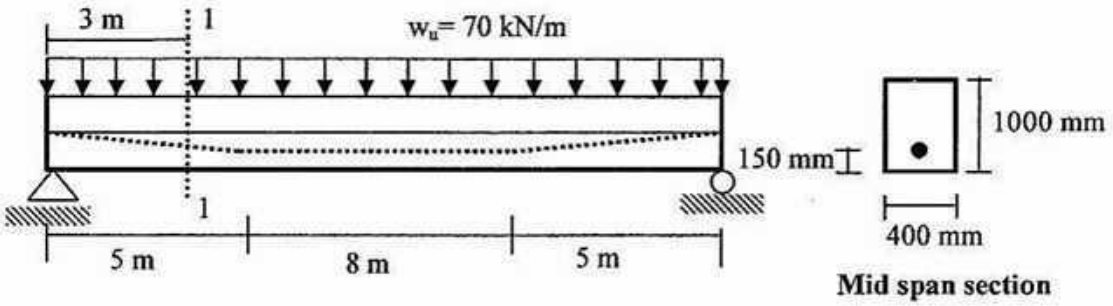
3. a) Make final design for the preliminary section as shown in following figure using large ratio of M_G/M_T concept. Given that:
M_G = 285 kN-m, M_T = 435 kN-m. Allowing f_b = -12.5 MPa, f_t = -11 MPa, f_{so} = 1035 MPa, f_{se} = 860 MPa. 16



b) Describe the minimum longitudinal reinforcement and minimum cover requirement for prestressed concrete beam. 04

4. a) Check shear strength at section 1-1 for the following beam. Given that this section is adequate for w_u= 70 kN/m on the basis of its flexural strength.

Given: f_c'= 40 MPa, f_{so}=1200 MPa, f_{se}= 1000 MPa, A_{ps}=1760 mm^2 16



b) Write a short note on flexural bond strength. 04

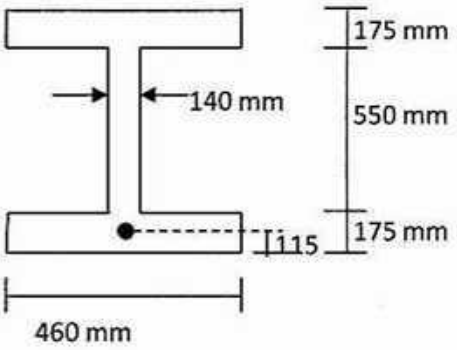
5. a) Categories different types of cracks for a simply supported beam and comment on the cracks with respect to the shear –moment ratio. 06
b) Draw the cable layout for any three cantilever beams. 06
c) Define "transfer length" in pretensioned concrete member. Write down the parameters which affect the transfer length for prestressing steel of pretensioned member. 08

6. Design a simply supported Prestressed concrete beam of span 30m having an overall depth of 1.8 m. The beam is to support a total load 15 kN/m, including self weight. Given: f_c'= 30 MPa, f_{pu}= 1600 MPa , f_{so} =0.7 f_{pu} , f_t=-13.5 Mpa , f_b=-19.5 MPa.

Design as T beam and assume total loss=20%. 20

7. a). **Draw the stress distribution** in a composite section under various stages of loading in its life time. 04

b) Calculate the ultimate moment capacity of the PC beam shown in the following figure. The beam is prestressed with A_{ps}=2350 mm^2 with an effective prestress, f_{se}=1100 MPa. Given: f_{pu}=1860 MPa, f_c'=48 MPa. 16



Annexure-1

Formulas

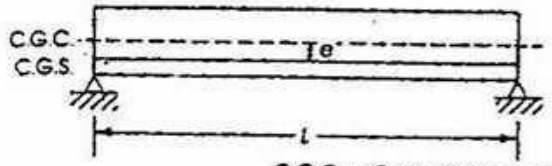
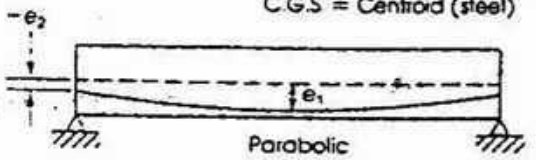
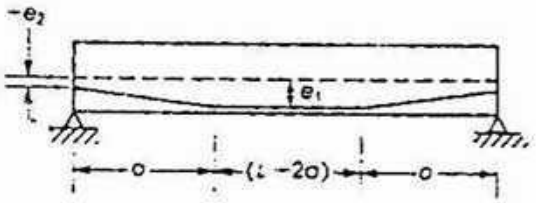
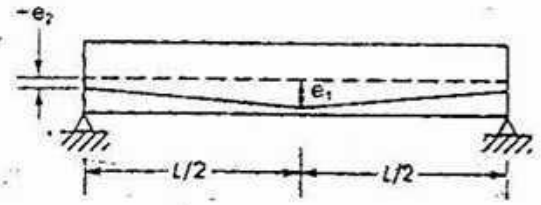
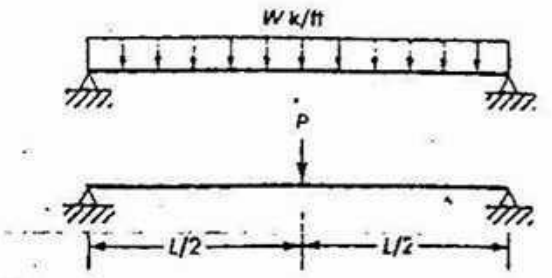
- $ES=(E_s/E_{ci})\times f_{cir}= n\times(F_o/ A + F_o e^2/I - M_g e/I)$

[F_o= 0.9F_i (pretensioned member)]

- $e= M_G/F_o + k_b$
- $e= (M_G+f_t' A k_b)/F_o + k_b$
- $F=M_T/(e+k_t)$
- $F=(M_T-f_b' A k_t)/(e+k_t)$
- $A_c = \dfrac{F_o h}{f_b c_t - f_t' c_b}$
- $A_c = \dfrac{Fh}{f_t c_b - f_b' c_t}$
- $A_c = \dfrac{Fh}{f_t c_b}$
- $A_c = \dfrac{F_o h}{f_b c_t}$
- $A_c = \dfrac{F_0}{f_b}\left(1 + \dfrac{e - (\frac{M_G}{F_0})}{k_t}\right)$
- $V_{ci}=0.05\sqrt{f_c'}\, b_w d + V_d + V_i M_{cr}/M_{max} \geq 0.14\sqrt{f_c'}\, b_w d$
- $M_{cr}=[I/y_t]\times(0.5\sqrt{f_c'}+f_{pe}-f_d)$
- $V_{cw}= 0.29\sqrt{f_c'}\, b_w d + 0.3 f_{pc} b_w d + V_p$
- $\Delta = -\Delta_{pi} + \Delta_0$
- $\Delta = -\Delta_{pi} - \dfrac{\Delta_{pi} + \Delta_{pe}}{2} C_t + (\Delta_0 + \Delta_d)(1 + C_t) + \Delta_l$
- $C_t = \dfrac{t^{0.60}}{10 + t^{0.60}} C_u$

Annexure-2

MIDSPAN DEFLECTIONS OF SIMPLY SUPPORTED BEAMS

Schematic	*Deflection equations*	
Camber due to prestressing force		
	$\Delta = \frac{(Fe)L^2}{8EI}$	(1)
	(Horizontal tendons)	
C.G.C. = Centroid (concrete) C.G.S = Centroid (steel)	$\Delta = \frac{FL^2}{8EI}\left[\frac{5}{6}e_1 + \frac{1}{6}e_2\right]$	(2)
	When $e_2 = 0$:	
	$\Delta = \frac{5(Fe_1)L^2}{48EI}$	(3)
	$\Delta = \frac{FL^2}{8EI}\left[e_1 + \frac{4}{3}\left(\frac{a}{L}\right)^2(e_2 - e_1)\right]$	(4)
	When $a = \frac{L}{3}$:	
	$\Delta = \frac{FL^2}{8EI}\left[e_1 + \frac{4}{27}(e_2 - e_1)\right]$	(5)
	When $a = \frac{L}{3}$ and $e_2 = 0$:	
	$\Delta = \frac{23(Fe_1)L^2}{216EI}$	(6)
	$\Delta = \frac{FL^2}{24EI}[2e_1 + e_2]$	(7)
	When $e_2 = 0$:	
	$\Delta = \frac{(Fe_1)L^2}{12EI}$	(8)
Deflection due to gravity loads		
	$\Delta = \frac{5wL^4}{384EI}$	(9)
	$\Delta = \frac{PL^3}{48EI}$	(10)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc Engineering (Civil)

Course Title: Structural Engineering VI (Design of Steel Structures) | Course Code: CE417
Time: 2.00 Hours | Full Marks: 100

[The figures in the margin indicate full marks. Assume reasonable values for any missing data. Annexures provided to facilitate design]

There are EIGHT questions. Answer any SIX questions

1. Using AISC/ASD method, determine the block shear allowable load for the joint shown in Fig. 1. Fasteners are 3/4-in A-325 bolts in standard holes. All plates are A36 steel. See Annexure-1. 16 2/3

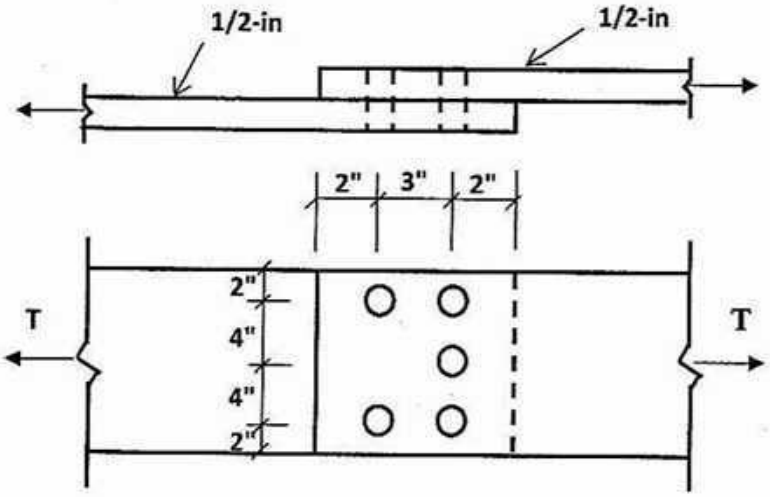


Fig. 1

2. Using AISC/LRFD method, check whether the joint shown in Fig. 1 is adequate in block shear to carry a dead load of 50 kip along with a live load of 80 kip. Fasteners are 3/4-in A-325 bolts in standard holes. All plates are of steel with F_y = 50 ksi and F_u = 70 ksi. See Annexure-1. 16 2/3

3. The webless H section shown in Fig. 2 has the residual stress distribution as shown in the figure. Determine values of $I_{x,eff}$ and $I_{y,eff}$ (effective moments of inertia about x and y axes), if a column with the given section buckles at an imposed uniform compressive strain of –0.0010 in./in. Given: F_y = 36 ksi and E = 30000 ksi. 16 2/3

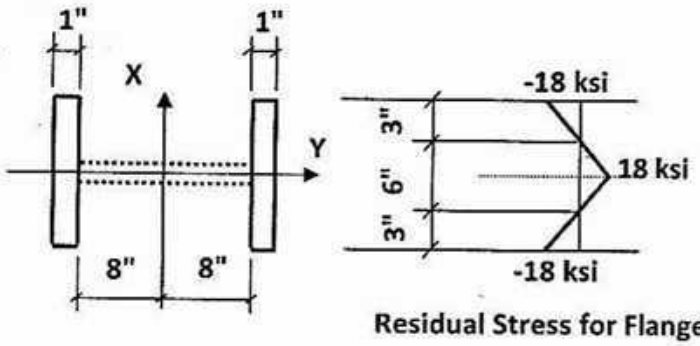


Fig. 2

Residual Stress for Flanges

4. The residual stress for a 16x1-in. plate to be used as a tension member is shown in Fig. 3. Determine the average stress in the plate at an imposed tensile strain of 0.0014. Given: F_y=36 ksi; E=30000 ksi. 16 2/3

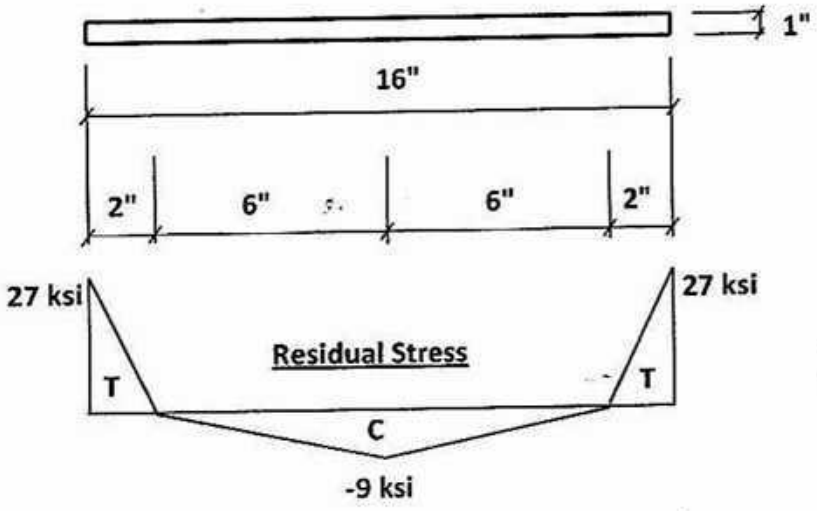


Fig. 3

5. Design a building column by AISC/ASD method using W10 sections (see Annexure-2). The column is 15 ft long and has to support a dead load of 50 kips and a live load of 200 kips. Assume K=1 for both X and Y axes. Given: F_y = 36 ksi and E = 29000 ksi. 16 2/3

6. Compute the yield moment, plastic moment and shape factor for bending about major axis of the section shown in Fig. 4. Given F_y = 42 ksi. 16 2/3

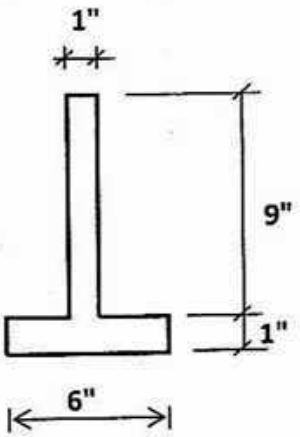


Fig. 4

7. Determine, the maximum uniformly distributed load that may be safely carried by a beam on a 32-ft simply supported span, if it has a wide flange section W24x68 with section modulus S_x = 154 in^3. Assume that compact section requirements will be satisfied and hence, design the spacing of lateral bracings. Also check whether the deflection criterion is satisfied or not. Given: F_y = 36 ksi; For beam section W24x68, d = 23.73 inch, b_f = 8.965 inch and d/A_f = 4.52. Annexure-3 is provided to facilitate the design. 16 2/3

8. Determine the effective length coefficients for the columns of the frame shown in Fig. 5. The moments of inertia in inch^4 for the columns and beams are shown in the figure. Annexure-4 provides necessary nomographs. 16 2/3

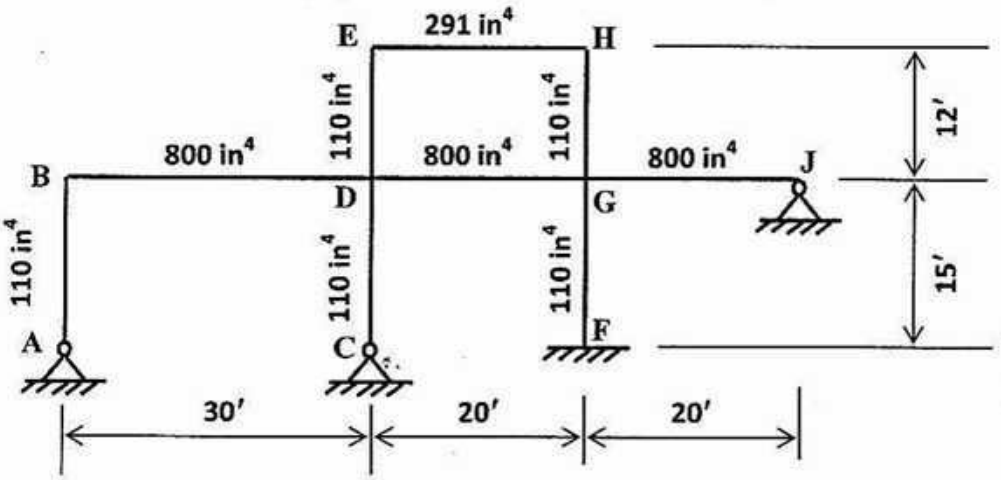


Fig. 5

ANNEXURE-1

For block shear in AISC/ASD, allowable stress in shear on net shear area,

$$F_v = 0.30F_u$$

and allowable stress in tension on net tension area,

$$F_t = 0.50F_u$$

For block shear in AISC/LRFD, design strength, may be obtained from the formulas,

$$\phi R_n = \begin{cases} 0.75(0.6F_y A_{gv} + F_u A_{nt}) \\ 0.75(0.6F_u A_{nv} + F_y A_{gt}) \end{cases}$$

ANNEXURE-2

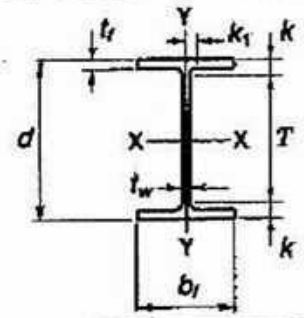
The AISC/ASD formulas for allowable stress F_a on axially loaded compression members are

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

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

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

ANNEXURE-2 (Contd.)

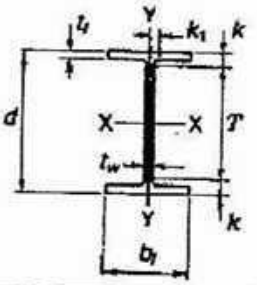


W SHAPES
Dimensions

Designation	Area A	Depth d		Web: Thickness t_w		$\frac{t_w}{2}$	Flange: Width b_f		Flange: Thickness t_f		Distance T	Distance k	Distance k_1
	In.^{2}	In.		In.		In.	In.		In.		In.	In.	In.
W 10×112	32.9	11.36	11⅜	0.755	¾	⅜	10.415	10⅜	1.250	1¼	7⅞	1⅜	1⁵⁄₁₆
×100	29.4	11.10	11⅛	0.680	11⁄16	⅜	10.340	10⅜	1.120	1⅛	7⅞	1¼	⅞
× 88	25.9	10.84	10⅞	0.605	⅝	5⁄16	10.265	10¼	0.990	1	7⅛	1⅛	1³⁄₁₆
× 77	22.6	10.60	10⅝	0.530	½	¼	10.190	10¼	0.870	⅞	7⅛	1⅛	1³⁄₁₆
× 68	20.0	10.40	10⅜	0.470	½	¼	10.130	10⅛	0.770	¾	7⅛	1⅛	¾
× 60	17.6	10.22	10¼	0.420	7⁄16	¼	10.080	10⅛	0.680	11⁄16	7⅛	1⅛	¾
× 54	15.8	10.09	10⅛	0.370	⅜	3⁄16	10.030	10	0.615	⅝	7⅛	1¼	1¹⁄₁₆
× 49	14.4	9.98	10	0.340	5⁄16	3⁄16	10.000	10	0.560	9⁄16	7⅛	1¹⁄₁₆	1¹⁄₁₆
W 10× 45	13.3	10.10	10⅛	0.350	⅜	3⁄16	8.020	8	0.620	⅝	7⅛	1¼	1¹⁄₁₆
× 39	11.5	9.92	9⅞	0.315	5⁄16	3⁄16	7.985	8	0.530	½	7⅛	1⅛	1¹⁄₁₆
× 33	9.71	9.73	9¾	0.290	5⁄16	3⁄16	7.960	8	0.435	7⁄16	7⅛	1¹⁄₁₆	1¹⁄₁₆
W 10× 30	8.84	10.47	10½	0.300	5⁄16	3⁄16	5.810	5¾	0.510	½	8⅛	15⁄16	½
× 26	7.61	10.33	10⅜	0.260	¼	⅛	5.770	5¾	0.440	7⁄16	8⅛	⅞	½
× 22	6.49	10.17	10⅛	0.240	¼	⅛	5.750	5¾	0.360	⅜	8⅛	¾	½
W 10× 19	5.62	10.24	10¼	0.250	¼	⅛	4.020	4	0.395	⅜	8⅛	13⁄16	½
× 17	4.99	10.11	10⅛	0.240	¼	⅛	4.010	4	0.330	5⁄16	8⅛	¾	½
× 15	4.41	9.99	10	0.230	¼	⅛	4.000	4	0.270	¼	8⅛	11⁄16	7⁄16
× 12	3.54	9.87	9⅞	0.190	3⁄16	⅛	3.960	4	0.210	3⁄16	8⅛	⅝	7⁄16

ANNEXURE-2 (Contd.)

W SHAPES
Properties



Designation	Nominal Wt. per Ft	Compact Section Criteria				r_T	$\frac{d}{A_f}$	Elastic Properties						Plastic Modulus	
		$\frac{b_f}{2t_f}$	F_y'	$\frac{d}{t_w}$	F_y''			Axis X-X			Axis Y-Y			Z_x	Z_y
								I	S	r	I	S	r		
	Lb.		Ksi		Ksi	In.		In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.	In.^{3}	In.^{3}
W 10×112	112	4.2	—	15.0	—	2.88	0.87	716	126	4.66	236	45.3	2.68	147	69.2
×100	100	4.6	—	16.3	—	2.85	0.96	623	112	4.60	207	40.0	2.65	130	61.0
× 88	88	5.2	—	17.9	—	2.83	1.07	534	96.5	4.54	179	34.8	2.63	113	53.1
× 77	77	5.9	—	20.0	—	2.80	1.20	455	85.9	4.49	154	30.1	2.60	97.6	46.9
× 68	68	6.6	—	22.1	—	2.79	1.33	394	75.7	4.44	134	26.4	2.59	85.3	40.1
× 60	60	7.4	—	24.3	—	2.77	1.49	341	68.7	4.39	116	23.0	2.57	74.6	35.0
× 54	54	8.2	63.5	27.3	—	2.75	1.64	303	60.0	4.37	103	20.6	2.56	66.6	31.3
× 49	49	8.9	53.0	29.4	—	2.74	1.78	272	54.6	4.35	93.4	18.7	2.54	60.4	28.3
W 10× 45	45	6.5	—	28.9	—	2.18	2.03	248	49.1	4.32	53.4	13.3	2.01	54.9	20.3
× 39	39	7.5	—	31.5	—	2.16	2.34	209	42.1	4.27	45.0	11.3	1.98	46.8	17.2
× 33	33	9.1	50.5	33.6	58.7	2.14	2.81	170	35.0	4.19	36.6	9.20	1.94	38.8	14.0
W 10× 30	30	5.7	—	34.9	54.2	1.55	3.53	170	32.4	4.38	16.7	5.75	1.37	36.6	8.84
× 26	26	6.6	—	39.7	41.8	1.54	4.07	144	27.9	4.35	14.1	4.89	1.36	31.3	7.50
× 22	22	8.0	—	42.4	36.8	1.51	4.91	118	23.2	4.27	11.4	3.97	1.33	26.0	6.10
W 10× 19	19	5.1	—	41.0	39.4	1.03	6.45	96.3	18.8	4.14	4.29	2.14	0.874	21.6	3.35
× 17	17	6.1	—	42.1	37.2	1.01	7.84	81.9	16.2	4.05	3.56	1.78	0.844	18.7	2.80
× 15	15	7.4	—	43.4	35.0	0.99	9.25	68.9	13.8	3.95	2.69	1.45	0.810	16.0	2.30
× 12	12	9.4	47.6	51.9	24.5	0.96	11.9	53.8	10.9	3.90	2.18	1.10	0.785	12.6	1.74

ANNEXURE-3

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: $$F_b = 0.66F_y \qquad (5\text{-}16a)$$

Noncompact section: $$F_b = 0.60F_y \qquad (5\text{-}16b)$$

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

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

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

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:

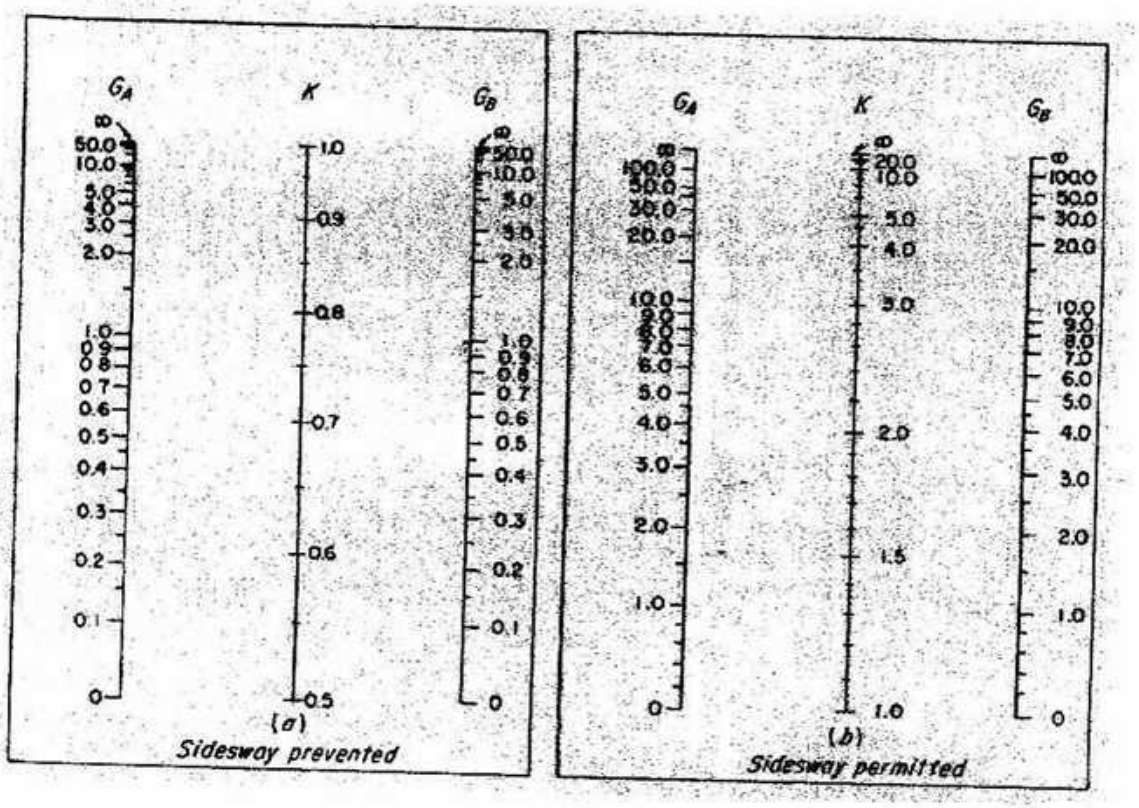
$$L_c = \frac{76b_f}{\sqrt{F_y}} \qquad (5\text{-}17a)$$

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

DESIGN FOR LIMITED DEFLECTION

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

ANNEXURE-4



Nomograph for effective length of columns.

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering III — Course Code: CE 431
Time- 2 hour — Full marks: 100

Answer any four questions out of five.
(Note: Assume any missing data)

1. (a) Write down the main objectives of solid waste management. Discuss the functional elements of a complete solid waste management. (3+6)

   (b) What is source reduction? Discuss the significance of source reduction. (2+4)

   (c) A recent study on recycling at the Los Angeles International Airport found that 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 (Atkins, 2006). (10)

      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 ?

2. (a) Define the following terms as per HCS and SCS: (3)
      i. pick-up time
      ii. haul time
      iii. at site time

   (b) Describe about the solid waste collection vehicle routing (both methods with figures). (5)

   (c) Write down the environmental justification of recycling and reuse. (7)

   (d) What is break-even distance (with figure) ? (2)
   Determine the break-even time for a stationary- container system and a separate transfer & transport system for transporting wastes collected from a metropolitan area to a landfill disposal site. Assume the following cost and system data are applicable. (8)

I. Transportation costs:
   i. Stationary-container system using an 18-m^3 compactor = \$20 / hr
   ii. Tractor-trailer transport unit with a capacity of 120 m^3 = \$ 25/hr

II. Other costs:
   i. Transfer station operating cost, including amortization =\$ 0.40/m^3
   ii. Extra cost for unloading facilities for tractor-trailer transport unit= \$ 0.05/m^3

III. Other data:
   i. Density of wastes in compactor = 325 kg/m^3
   ii. Density of wastes in transport units = 150 kg/m^3

3. (a) What are the differences between biogas and composting method ? (3)

   (b) Write down the advantages of anaerobic digestion. (6)

   (c) Determination of screen recovery efficiency and effectiveness. (7)
   Given that 2500 kg/h of municipal solid waste with 10 percent glass is applied to a rotary screen for the removal of glass prior to shredding. Weight of underflow is 500 kg/h and weight of glass in screen underflow is 200 kg/h, determine the recovery efficiency and effectiveness of the screen.

   (d) Estimation of the amount of gas produced from the organic fraction of MSW under anaerobic conditions. Estimate the total theoretical amount of gas that could be produced under anaerobic conditions in a sanitary landfill per unit weight of solid wastes given that the chemical formulas of the typical waste are as follows: (9)

   Without water: $C_{60.0}H_{94.3}O_{37.8}N$

   With water : $C_{60.0}H_{56.3}O_{69.1}N$

   Given that the total weight of organic material in 100 lb of solid waste is equal to 75.0 lb including moisture.

4. (a) Where and what type of landfill system is adopted in Dhaka with technical assistance of the Japan International Cooperation Agency ? (3)

   (b) Discuss the different generation phases of landfill gases with necessary figures. (6)

   (c) Discuss the storm water management in landfill site ? (10)

   (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)

5. (a) Which land disposal technique is suitable for the hazardous waste of Bangladesh ? (5)
   Give appropriate judgment against the answer.

(b) Discuss the healthcare waste management system. (20)

Note: The necessary data and chart are given below:

$$C_aH_bO_cN_d+\left(\frac{4a-b-2c+3d}{4}\right)H_2O\rightarrow\left(\frac{4a+b-2c-3d}{8}\right)CH_4$$
$$+\left(\frac{4a-b+2c+3d}{8}\right)CO_2+dNH_3$$

TABLE 9.8

Materials	Source Reduction: Current Mix of Inputs	Source Reduction: 100% Virgin Inputs	Recycling or Composting versus Landfilling	Combustion versus Landfilling
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 Fall 2011
Program: B Sc. Engineering (Civil)

Course Title: Environmental Engineering IV | Course No. CE 433
Time: 2 Hours | Full Marks: 135

Answer ANY THREE of the following Four Questions

1. (a) A power plant discharges 250 kg of SO_2 per hour through a stack, which has an effective height of 70 meters. The wind velocity at a height of 10 m is 4.5 m/sec, and the atmosphere is "neutral". Determine ground level SO_2 concentration at 1.5 km downwind, along the centre-line of the plume. (Given: p = 0.25; Table for calculation of dispersion coefficient provided) **25**

   (b) How does a three-way catalytic converter help reduce emissions of pollutants from a car? How does air-fuel ratio affect efficiency of a catalytic converter? **10**

   (c) Based on available data, which air pollutants are of particular concern in Dhaka? During which period of the year air quality becomes worse? During which period air quality improves and what are the reasons for this improvement? **10**

2. (a) On particular day, cars along a road are traveling at a speed of 50 km/hr and average distance between cars is 20 m. Each car is emitting carbon monoxide (CO) at a rate of 5.2 g/km. Wind speed is 3.2 m/sec perpendicular to the road and the atmosphere is "neutral". Estimate the ground level concentration of CO at 1 km downwind. **20**

   (b) What control devices are available for control of particulate contaminants from industrial sources? **5**

   (c) Classify air pollutants according to origin, chemical composition and state of matter. Give at least two examples of each class. Also define primary and secondary pollutants. **10**

   (d) What mechanisms are most important for deposition of particles in the respiratory system? Provide appropriate sketches to explain these mechanisms. Which of these mechanisms are primarily responsible for deposition of relatively smaller (< 0.5 mm) particles? **10**

3. (a) Suppose the ambient temperature profile is given by the following equation: **11**

   $\Lambda = 30 - 0.005\ Z$, where Z = altitude in m

   (i) If maximum surface temperature is 35 °C and average wind speed is 5.0 m/sec, estimate the ventilation coefficient and comment on the pollution potential of the area.

   (ii) If a plume is emitted at a temperature of 32 °C from the top of a 100 m high stack, up to what height it would rise under the existing conditions?

   (b) What do you understand by "Thermal NO_x" and "Fuel NO_x"? **11**
   What do you understand by photochemical smog? What are its principal constituents?

   (c) Particulates of anthropogenic (i.e. man-made) origin are considered more harmful compared to particulates of natural origin. Explain why. **10**

(d) With respect to internal combustion engines, what do you understand by: (i) stoichiometric ratio, (ii) lean mixture, (iii) rich mixture 13
Explain the effect of "air-fuel ratio" on emission of CO, HC and NO_x from a four-stroke engine.

4. (a) On a particular day, air quality of Dhaka are as follows: 16

O_3 (8-hr) = 160 $\mu g/m^3$
CO (8-hr) = 8 ppm
$PM_{2.5}$ (24-hr) = 175 $\mu g/m^3$

Determine AQI for each parameter and report AQI of Dhaka for that particular day (Given: T = 21 °C, P = 1 atm; Table for calculating AQI provided).

(b) What are the major pollutants of concern for diesel engines? Are catalytic converters suitable for controlling emissions from a diesel engine? Explain. 8

(c) What are the major sources of carbon monoxide (CO) in urban areas? Explain how CO affects oxygen carrying capacity of blood. 11

(d) On a global scale, what are the major sources of SO_x in the atmosphere? Why SO_x is particularly harmful in dusty atmosphere? Explain. 10

Table 7.3 Values of the constants *a*, *c*, *d*, and *f* for use in ~~(7.44) and (7.45)~~ expressions for σ_y and σ_z

		$x \le 1$ km			$x \ge 1$ km		
Stability	*a*	*c*	*d*	*f*	*c*	*d*	*f*
A	213	440.8	1.941	9.27	459.7	2.094	−9.6
B	156	106.6	1.149	3.3	108.2	1.098	2.0
C	104	61.0	0.911	0	61.0	0.911	0
D	68	33.2	0.725	−1.7	44.5	0.516	−13.0
E	50.5	22.8	0.678	−1.3	55.4	0.305	−34.0
F	34	14.35	0.740	−0.35	62.6	0.180	−48.6

Note: The computed values of σ will be in meters when x is given in kilometers.
Source: Martin (1976).

$\sigma_y = a.x^{0.894}$; $\sigma_z = cx^d + f$

Table 1: AQI for different pollutants (for ques. no: ~~4(a)~~)

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

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

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering VII — Course Code: CE 439
Time- 2 hour — Full marks: 100

Answer any four questions including question No. 5.
(Note: Question No. 5 is compulsory)

1. a. Discuss the importance of EIA (Environmental Impact Assessment) for a construction related project. (5)

   b. Write down the contents of EIA report with brief description. (20)

2. a. What are the environment protection relevant policies & acts in Bangladesh ? (12)

   b. When does EIA starts in a project ? (5)

   c. Define overlays method and Environmental Evaluation System (EES) method. (8)

3. a. Discuss briefly different types of environmental impacts. (20)

   b. Discuss generic items of Terms of Reference (TOR) to conduct EIA. (5)

4. a. Why baseline survey is necessary for EIA ? Write down the relationship between baseline study and monitoring. (13)

   b. Why public involvement in EIA is most significant part ? What are the participation techniques ? (12)

5. a. Due to implementation of a road project the following potential negative impacts will be occurred: Loss of land ; loss of income; loss of trees; deposition of silt on crop fields; dust blowing; noise level rise; water runoff from construction site at canal etc. (20)

   Prepare an environmental Mitigation plan.

   b. Categories the following project into green, orange-A, orange-B and red category projects. (5)
   Assembling & manufacturing of computers, TV, radio etc; mobile phone tower; biscuits and bread factory; pharmaceutical; recycling of lead acid battery; hazardous waste storage, treatment and disposal site including hazardous waste incineration.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course # CE 441 | Course Title: Geotechnical Engineering II
Full Marks: 120 (20 X 6 = 120) | Time: 3 hours

Answer any 6 (six) of the following 8 (eight) questions

1. (a) Mention four purposes of geotechnical subsurface exploration. 2

(b) Write down any two general guidelines (GG) used for the selection of depth of boreholes for civil engineering projects. 2

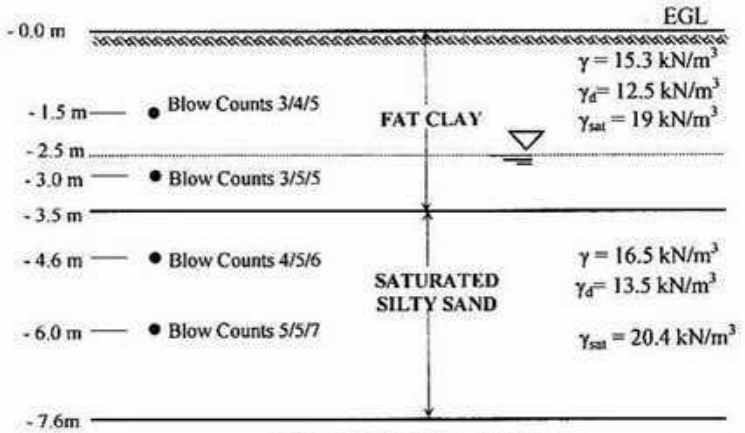
(c) Mention the name of the in-situ test most frequently used in Bangladesh. Write a short note on this test. 1 + 4 = 5

(d) The outside and inside diameters of a split-spoon sampler are 50.8 mm and 34.93 mm, respectively. The outside and inside diameters of a Shelby tube sampler are 76.2 mm and 73 mm, respectively. Estimate the degree of disturbances for two soil samples; one obtained using the split-spoon sampler and the other using the Shelby tube. Also determine whether the samples are disturbed or undisturbed. 5

(e) Write short notes (any two) on: (i) Vane Shear Test (ii) Cone Penetration Test (iii) Pressuremeter test. 3 X 2 = 6

2. (a) A geotechnical site investigation was conducted at a site in Dhaka. The field blow counts and subsurface stratigraphy as obtained at the site for a particular boring are summarized in the following figure below. Determine the Field SPT values. Apply necessary corrections (for 60% energy and overburden) and calculate the corrected SPT values as required (Use Appendix A, as necessary) for the field SPT values. Also determine the angle of internal friction of the silty sand layer at a depth of 6 m below EGL. 9

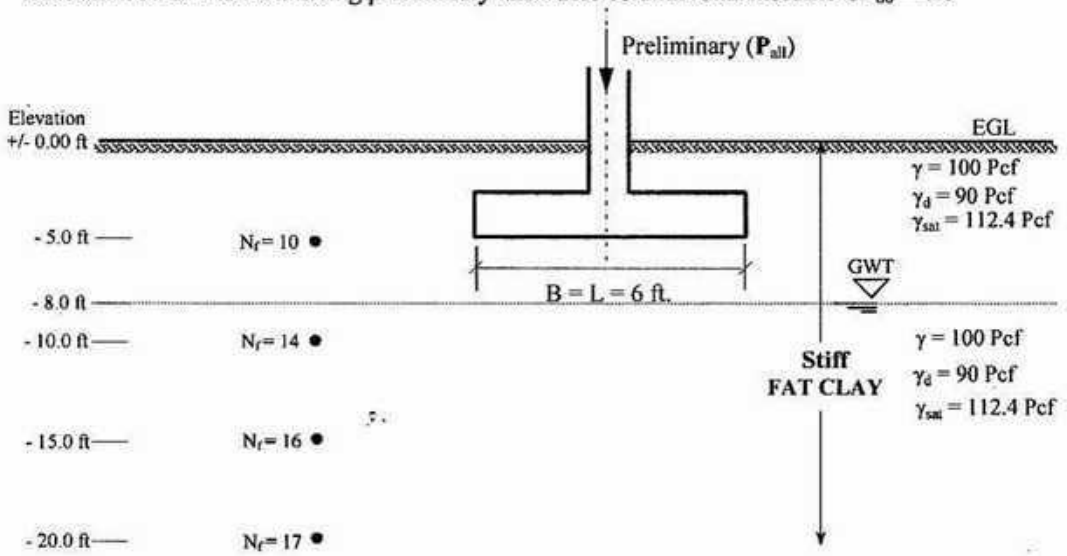
Note: - No liner was used during the drilling operation.



Subsurface Soil Stratigraphy

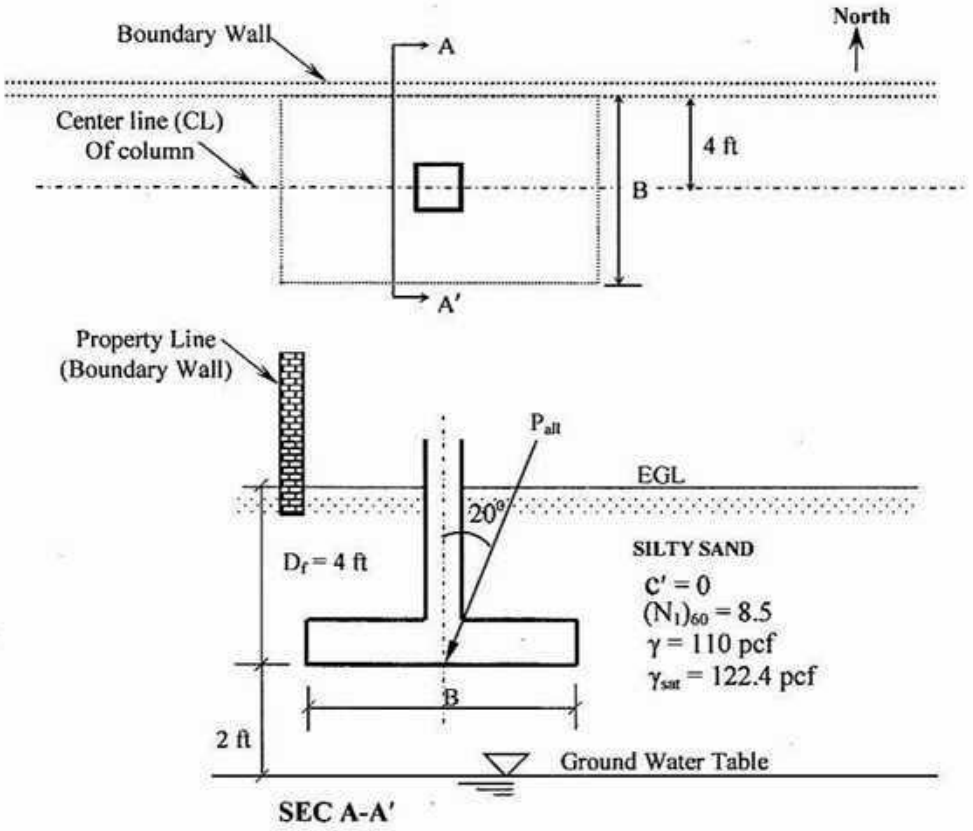
(b) During a field investigation SPT-N values were obtained at each 5-foot depth intervals. Using Terzaghi's bearing capacity equation (as appropriate), calculate the allowable column load of the individual column square footing for the following condition. Use 3:2:1 Method and FS = 3. 11

NOTES: No laboratory tests were conducted to obtain the shear strength of the clay formation. So, use empirical correlation (thumb) to estimate the average shear strength below the foundation level and use that for estimating preliminary allowable column load. Assume $CF_{60} = 1.0$

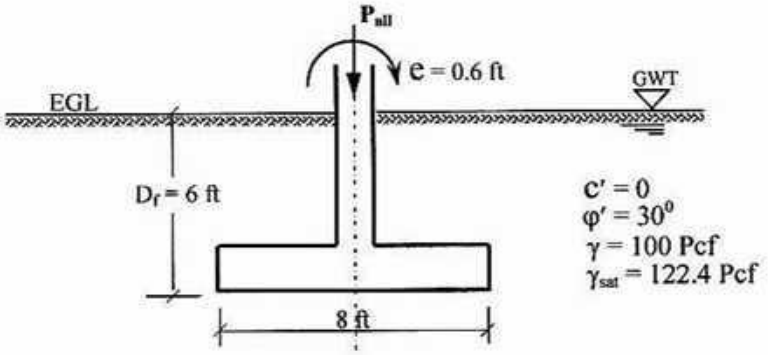


3. (a) For the following given conditions, determine the allowable column load (P_{all}) for the following footing. 10

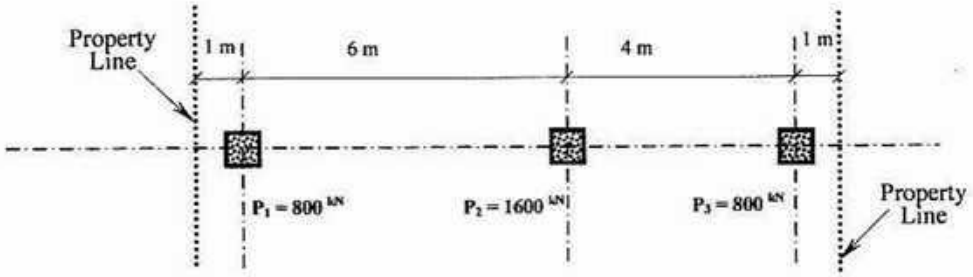
- Foundation spread cannot go beyond the interior of the boundary wall
- Centerline (CL) of the column is 4 feet south of the property line
- L = 1.5B
- Column location cannot be moved
- Factor of safety = 2.5
- Use general bearing capacity equation (GBCE)



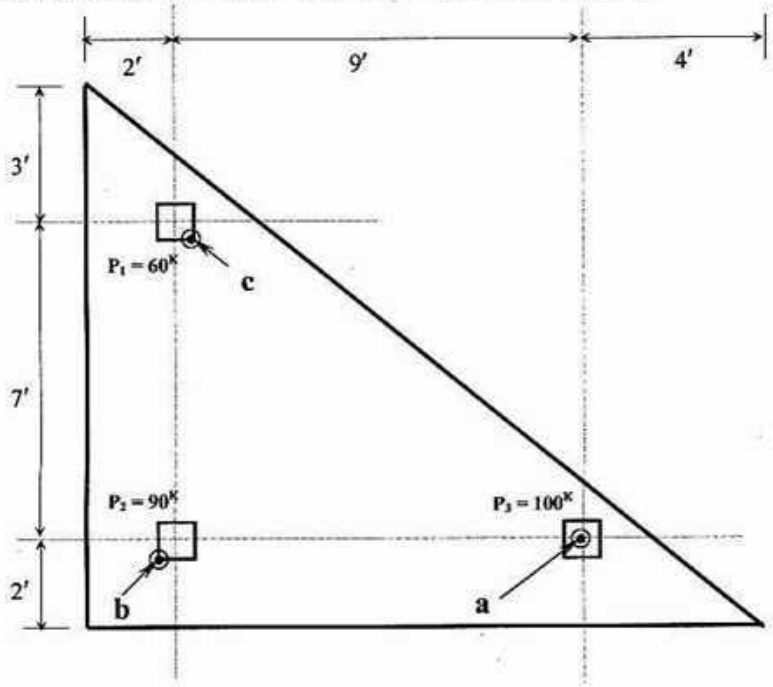
(b) An eccentrically loaded continuous foundation is shown below. Determine the allowable load per unit length that the foundation can carry. Use Meyerhof's effective area method. Use FS = 2.5. 10



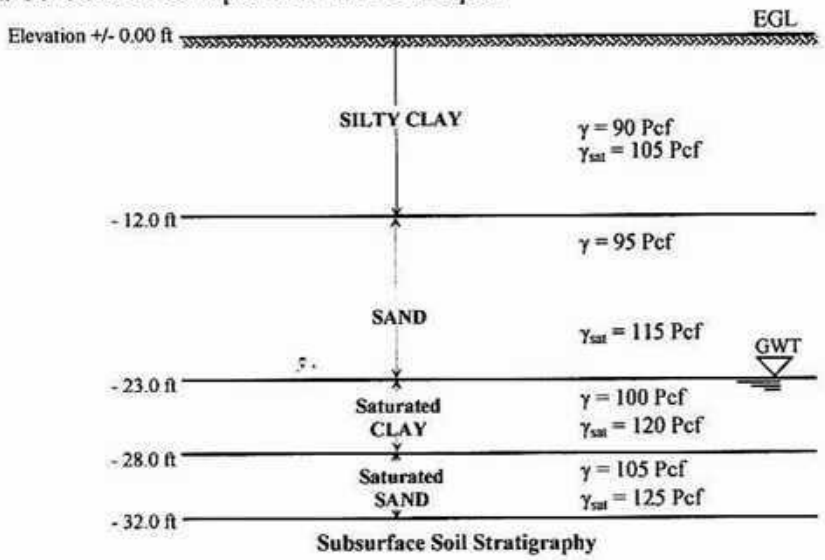
4. (a) Design the size of a trapezoidal combined footing for the loading, geometric and boundary conditions as shown in the figure below. Use allowable bearing capacity as 125 kN/m^2. 8



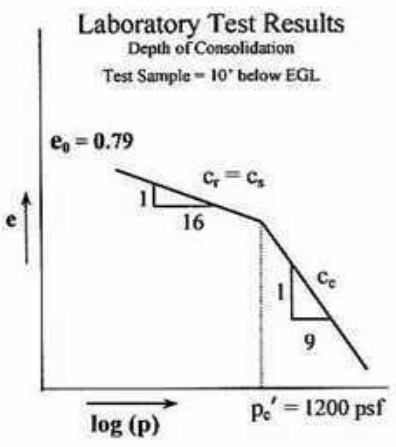
(b) The plan of a mat foundation with column loads and dimensions is shown in the following figure. Calculate the soil pressures at points a, b and c and at the geometric centroid of the foundation (All the columns are of 12 by 12 inches in size). 12

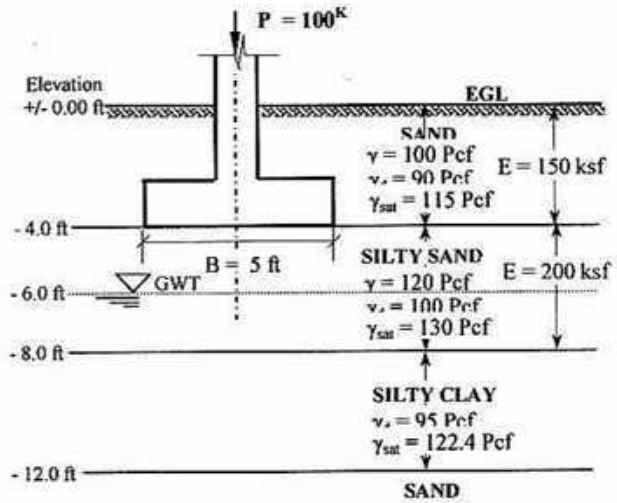


5. (a) For a fully compensated condition (floating foundation), if the depth of the mat foundation is selected to be 25 ft. below EGL, determine the number of stories that could be built. Consider uniform per floor load of 250 psf. 6

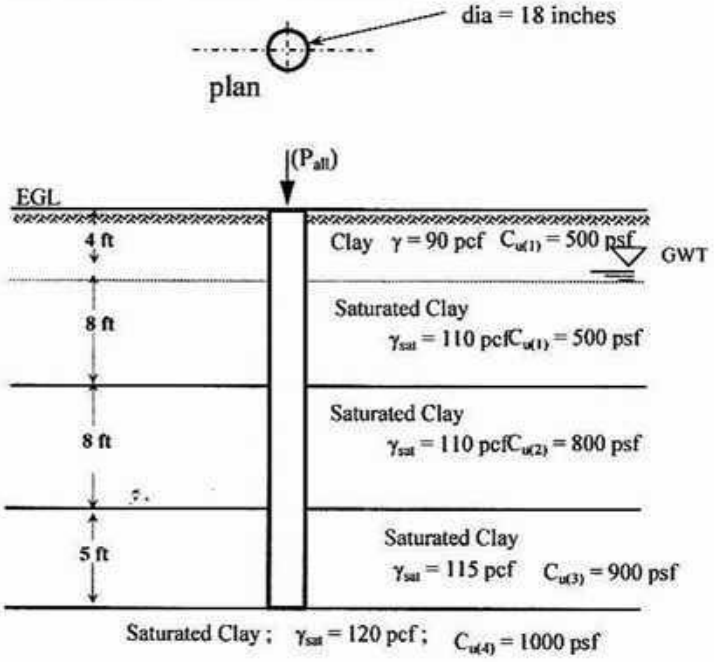


(b) A rectangular footing (5 ft x 10 ft) designed as per allowable bearing capacity based on shearing failure is shown in the following figure. Estimate settlements for both sand and clay layers. 14

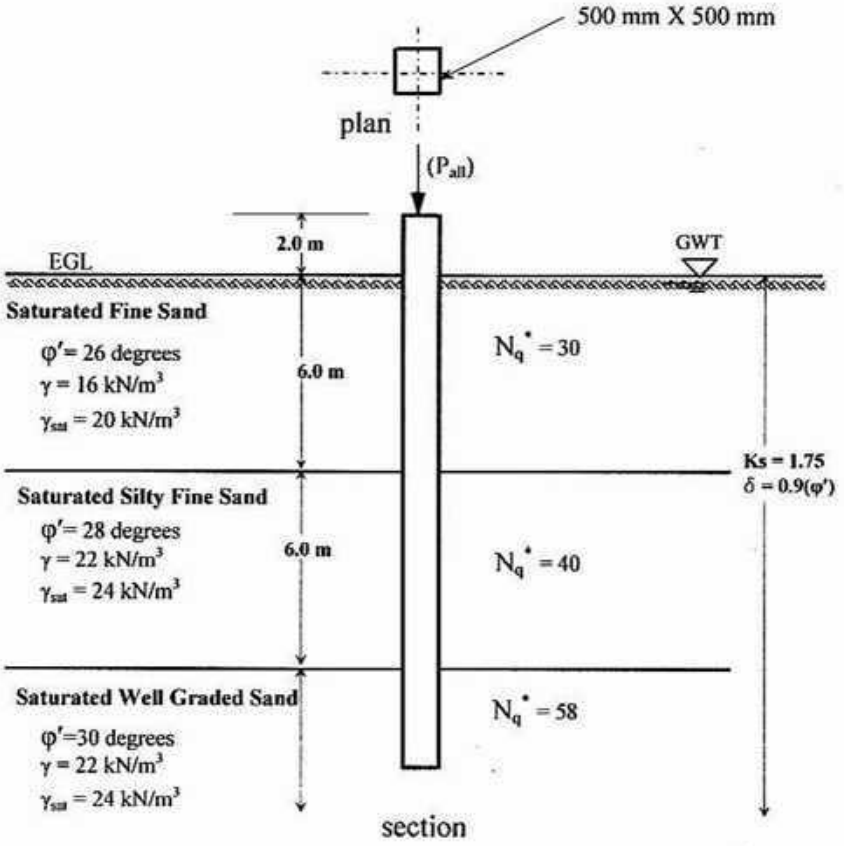




6. (a) A bored pile in clay is shown below. Calculate the allowable Capacity (P_{all}) of the pile for a factor of safety of 2.5 for both skin resistance and end bearing. 11



(b) The plan and X-section of a 18-meter long single pre-cast concrete pile (square) driven in different sand deposits are shown below. Estimate the allowable capacity of the single pile. 9



7. (a) For the soil stratigraphy and pile geometry as shown in question no. 6 (a), determine the capacity of a group of 6 piles, except the diameter of each pile is 24 inches and shear strength of each layer is reduced by 40%. 11

(b) Categorize (no description required) conventional retaining walls. Show sketch of a frequently used one. What are the criteria for checking the stability of a retaining wall ? Show with a sketch (no description required) the general proportioning geometry of a cantilever retaining wall. 9

8. (a) Classify pile foundations (mention names only) according to their materials (composition), method of installation and displacement criteria. 4

(b) Draw arrangements of group piles for the following sets of piles. 4

(i) 7 piles (ii) 10 piles

(c) Determine the factor of safety against the failure arc through the proposed slope shown below. 12

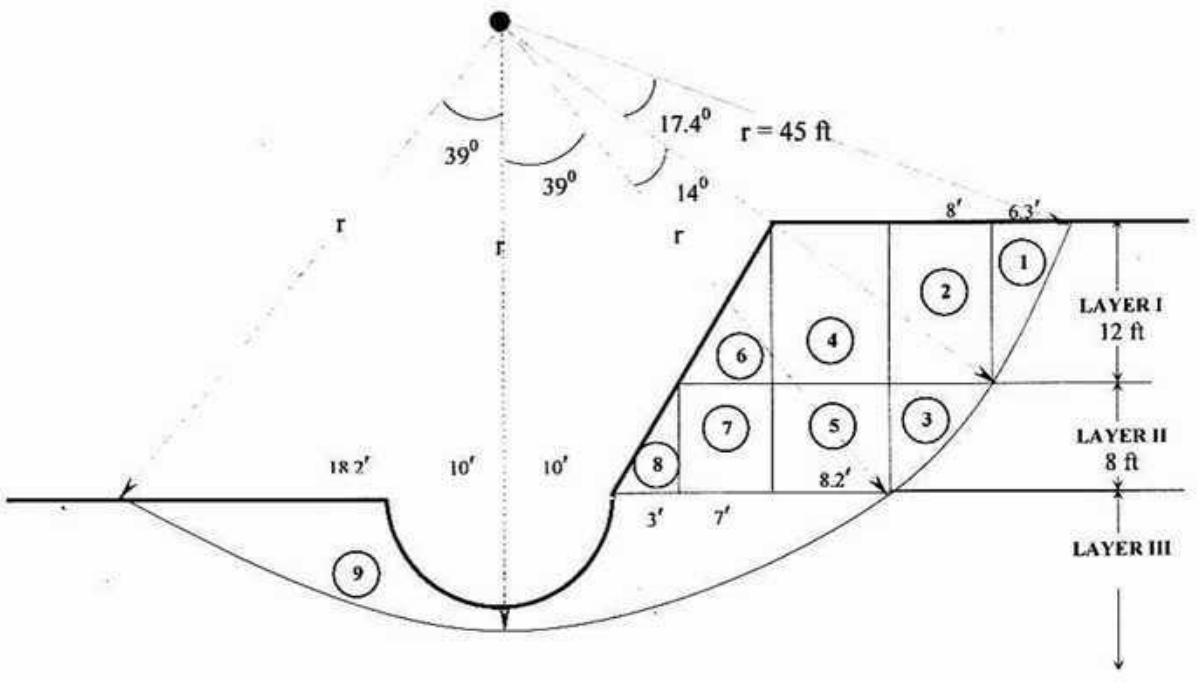
LAYER I:
Sandy Clay
Average SPT Blow Count, N = 11
Unit Weight = 115 pcf

LAYER II:
Clay
Average SPT Blow Count, N = 13
Unit Weight = 120 pcf

LAYER III:
Clay
Average SPT Blow Count, N = 15
Unit Weight = 125 pcf

Segment No.	Area (ft^2)	Arm (ft)
1	*	38.3
2	96	*
3	32	*
4	98.4	24.1
5	*	*
6	*	*
7	56	*
8	*	*
9	228	0

* To be calculated



University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
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 EIGHT questions. Answer any SIX

1. (a) List out common gauges with their dimension? Why is it desirable to use uniform gauges in a country? (3+10)
   (b) Establish a relationship between degree of curvature and versine of a curve. (6)
   (c) Write a short note on "Blanket Layer". (6)

2. (a) State the function of (12)
      i) Ballast
      ii) Elastic Fastening
      iii) Bearing plates
   (b) What are the advantages and disadvantages of wooden sleeper? (7)
   (c) Why generally the followings are favored? (6)
      i) Flat footed rail ii) Geo-textile

3. (a) What is coning of rails? What are the disadvantages of coning of wheels? (4+5)
   (b) What are the requirements of sleeper? What are the functions of rail? (5+5)
   (c) Briefly differentiate between point and crossing. (6)

4. (a) Elaborately explain different type of distresses in rigid and flexible pavement. Also discuss the causes of these distresses and relevant remedial measures. (20)
   (b) Draw a typical doweled expansion joint. (5)

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. (6+3)
   (b) Show the classification of different types of asphalt. Draw the simplified flow chart of recovery and refining of petroleum asphalts (5+5)
   (c) Explain "Pavement Serviceability Concept". (6)

6. (a) Compare the rigid and flexible pavement systems from various criteria. (7)
   (b) Write a short note on semi rigid pavement. (2)
   (c) For a four –lane expressway between Dhaka and Chittagong, the outer lanes have been decided to be cement concrete rigid pavement to carry heavy vehicles. Combined K of the sub grade and a 4 inch thick untreated granular base is 100 lb/in^3.Design period is 20 years. Over this period, the expected loadings of heavy vehicle in each direction are tabulated below. Determine the minimum thickness of slab that can be used safely for (16)

the outer lanes if the modulus of rupture of concrete is 650 psi (28 days). Assumed doweled joints and no concrete shoulder. Show calculations in a tabular form. Assume reasonable value for missing data, if any. Note: Use attached Fig. and Table.

Axle load, kips		Allowable repetitions for erosion analysis
Single axle	30	20,000
	26	75,000
	22	3500,000
	18	1000,00
	14	900,000
Tandem Axle	52	920,00
	48	1500,00
	32	2500,000
	40	4600,000
	36	9500,000
	32	Unlimited

7. (a) What do you mean by "pumping of joints"? How does pumping occur in rigid pavement? How can we prevent pumping action? (2+4+4)

(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: (15)

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 13% 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.

Table : Design Criteria for Marshall Method

Marshall method mix criteria	Surface and base					
	Light traffic		Medium traffic		Heavy traffic	
	Min.	Max.	Min.	Max.	Min.	Max.
Compaction, no. of blows each end of specimen	35		50		75	
Stability (lb)	750	-	1200	-	1800	-
Flow, 0.25 mm	8	18	8	16	8	14

(0.01 in)						
% Air voids	3	5	3	5	3	5
% VFA	70	80	65	78	65	75

8. (a) Discuss the outcomes of AASHO Road Test. (7)

(b) Design a minimum thickness of flexible pavement (i.e. thickness of different layers) for the following traffic condition: (18)

Daily Count	Axle load(kips)	ESAL Factor
2000 (Single Axle)	8	0.04
2000 (Single Axle)	15	0.10
100(Single Axle)	32	8.8
100 (Tandem Axle)	48	10

Given:
Sub grade soil CBR value is 5
Design life is 12 years
Traffic growth rate is 4% 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 Fig.

Table 6a. Equivalent Stress — No Concrete Shoulder (Single Axle/Tandem Axle)

Slab thickness, in.	k of subgrade-subbase, pci						
	50	100	150	200	300	500	700
4	825/679	726/585	671/542	634/516	584/486	523/457	484/443
4.5	699/586	616/500	571/460	540/435	498/406	448/378	417/363
5	602/516	531/436	493/399	467/376	432/349	390/321	363/307
5.5	526/461	464/387	431/353	409/331	379/305	343/278	320/264
6	465/416	411/348	382/316	362/296	336/271	304/246	285/232
6.5	417/380	367/317	341/286	324/267	300/244	273/220	256/207
7	375/349	331/290	307/262	292/244	271/222	246/199	231/186
7.5	340/323	300/268	279/241	265/224	246/203	224/181	210/169
8	311/300	274/249	255/223	242/208	225/188	205/167	192/155
8.5	285/281	252/232	234/208	222/193	206/174	188/154	177/143
9	264/264	232/218	216/195	205/181	190/163	174/144	163/133
9.5	245/248	215/205	200/183	190/170	176/153	161/134	151/124
10	228/235	200/193	186/173	177/160	164/144	150/126	141/117
10.5	213/222	187/183	174/164	165/151	153/136	140/119	132/110
11	200/211	175/174	163/155	154/143	144/129	131/113	123/104
11.5	188/201	165/165	153/148	145/136	135/122	123/107	116/98
12	177/192	155/158	144/141	137/130	127/116	116/102	109/93
12.5	168/183	147/151	136/135	129/124	120/111	109/97	103/89
13	159/176	139/144	129/129	122/119	113/106	103/93	97/85
13.5	152/168	132/138	122/123	116/114	107/102	98/89	92/81
14	144/162	125/133	116/118	110/109	102/98	93/85	88/78

Table 6b. Equivalent Stress — Concrete Shoulder (Single Axle/Tandem Axle)

Slab thickness, in.	k of subgrade-subbase, pci						
	50	100	150	200	300	500	700
4	640/534	559/468	517/439	489/422	452/403	409/388	383/384
4.5	547/461	479/400	444/372	421/356	390/338	355/322	333/316
5	475/404	417/349	387/323	367/308	341/290	311/274	294/267
5.5	418/360	368/309	342/285	324/271	302/254	276/238	261/231
6	372/325	327/277	304/255	289/241	270/225	247/210	234/203
6.5	334/295	294/251	274/230	260/218	243/203	223/188	212/180
7	302/270	266/230	248/210	236/198	220/184	203/170	192/162
7.5	275/250	243/211	226/193	215/182	201/168	185/155	176/148
8	252/232	222/196	207/179	197/168	185/155	170/142	162/135
8.5	232/216	205/182	191/166	182/156	170/144	157/131	150/125
9	215/202	190/171	177/155	169/146	158/134	146/122	139/116
9.5	200/190	176/160	164/146	157/137	147/126	136/114	129/108
10	186/179	164/151	153/137	146/129	137/118	127/107	121/101
10.5	174/170	154/143	144/130	137/121	128/111	119/101	113/95
11	164/161	144/135	135/123	129/115	120/105	112/95	106/90
11.5	154/153	136/128	127/117	121/109	113/100	105/90	100/85
12	145/146	128/122	120/111	114/104	107/95	99/86	95/81
12.5	137/139	121/117	113/106	108/99	101/91	94/82	90/77
13	130/133	115/112	107/101	102/95	96/86	89/78	85/73
13.5	124/127	109/107	102/97	97/91	91/83	85/74	81/70
14	118/122	104/103	97/93	93/87	87/79	81/71	77/67

Table 7a. Erosion Factors — Doweled Joints, No Concrete Shoulder (Single Axle/Tandem Axle)

Slab thickness, in.	k of subgrade-subbase, pci					
	50	100	200	300	500	700
4	3.74/3.83	3.73/3.79	3.72/3.75	3.71/3.73	3.70/3.70	3.68/3.67
4.5	3.59/3.70	3.57/3.65	3.56/3.61	3.55/3.58	3.54/3.55	3.52/3.53
5	3.45/3.58	3.43/3.52	3.42/3.48	3.41/3.45	3.40/3.42	3.38/3.40
5.5	3.33/3.47	3.31/3.41	3.29/3.36	3.28/3.33	3.27/3.30	3.26/3.28
6	3.22/3.38	3.19/3.31	3.18/3.26	3.17/3.23	3.15/3.20	3.14/3.17
6.5	3.11/3.29	3.09/3.22	3.07/3.16	3.06/3.13	3.05/3.10	3.03/3.07
7	3.02/3.21	2.99/3.14	2.97/3.08	2.96/3.05	2.95/3.01	2.94/2.98
7.5	2.93/3.14	2.91/3.06	2.88/3.00	2.87/2.97	2.86/2.93	2.84/2.90
8	2.85/3.07	2.82/2.99	2.80/2.93	2.79/2.89	2.77/2.85	2.76/2.82
8.5	2.77/3.01	2.74/2.93	2.72/2.86	2.71/2.82	2.69/2.78	2.68/2.75
9	2.70/2.96	2.67/2.87	2.65/2.80	2.63/2.76	2.62/2.71	2.61/2.68
9.5	2.63/2.90	2.60/2.81	2.58/2.74	2.56/2.70	2.55/2.65	2.54/2.62
10	2.56/2.85	2.54/2.76	2.51/2.68	2.50/2.64	2.48/2.59	2.47/2.56
10.5	2.50/2.81	2.47/2.71	2.45/2.63	2.44/2.59	2.42/2.54	2.41/2.51
11	2.44/2.76	2.42/2.67	2.39/2.58	2.38/2.54	2.36/2.49	2.35/2.45
11.5	2.38/2.72	2.36/2.62	2.33/2.54	2.32/2.49	2.30/2.44	2.29/2.40
12	2.33/2.68	2.30/2.58	2.28/2.49	2.26/2.44	2.25/2.39	2.23/2.36
12.5	2.28/2.64	2.25/2.54	2.23/2.45	2.21/2.40	2.19/2.35	2.18/2.31
13	2.23/2.61	2.20/2.50	2.18/2.41	2.16/2.36	2.14/2.30	2.13/2.27
13.5	2.18/2.57	2.15/2.47	2.13/2.37	2.11/2.32	2.09/2.26	2.08/2.23
14	2.13/2.54	2.11/2.43	2.08/2.34	2.07/2.29	2.05/2.23	2.03/2.19

Table 7b. Erosion Factors — Aggregate-Interlock Joints, No Concrete Shoulder (Single Axle/Tandem Axle)

Slab thickness, in.	k of subgrade-subbase, pci					
	50	100	200	300	500	700
4	3.94/4.03	3.91/3.95	3.88/3.89	3.86/3.86	3.82/3.83	3.77/3.80
4.5	3.79/3.91	3.76/3.82	3.73/3.75	3.71/3.72	3.68/3.68	3.64/3.65
5	3.66/3.81	3.63/3.72	3.60/3.64	3.58/3.60	3.55/3.55	3.52/3.52
5.5	3.54/3.72	3.51/3.62	3.48/3.53	3.46/3.49	3.43/3.44	3.41/3.40
6	3.44/3.64	3.40/3.53	3.37/3.44	3.35/3.40	3.32/3.34	3.30/3.30
6.5	3.34/3.56	3.30/3.46	3.26/3.36	3.25/3.31	3.22/3.25	3.20/3.21
7	3.26/3.49	3.21/3.39	3.17/3.29	3.15/3.24	3.13/3.17	3.11/3.13
7.5	3.18/3.43	3.13/3.32	3.09/3.22	3.07/3.17	3.04/3.10	3.02/3.06
8	3.11/3.37	3.05/3.26	3.01/3.16	2.99/3.10	2.96/3.03	2.94/2.99
8.5	3.04/3.32	2.98/3.21	2.93/3.10	2.91/3.04	2.88/2.97	2.87/2.93
9	2.98/3.27	2.91/3.16	2.86/3.05	2.84/2.99	2.81/2.92	2.79/2.87
9.5	2.92/3.22	2.85/3.11	2.80/3.00	2.77/2.94	2.75/2.86	2.73/2.81
10	2.86/3.18	2.79/3.06	2.74/2.95	2.71/2.89	2.68/2.81	2.66/2.76
10.5	2.81/3.14	2.74/3.02	2.68/2.91	2.65/2.84	2.62/2.76	2.60/2.72
11	2.77/3.10	2.69/2.98	2.63/2.86	2.60/2.80	2.57/2.72	2.54/2.67
11.5	2.72/3.06	2.64/2.94	2.58/2.82	2.55/2.76	2.51/2.68	2.49/2.63
12	2.68/3.03	2.60/2.90	2.53/2.78	2.50/2.72	2.46/2.64	2.44/2.59
12.5	2.64/2.99	2.55/2.87	2.48/2.75	2.45/2.68	2.41/2.60	2.39/2.55
13	2.60/2.96	2.51/2.83	2.44/2.71	2.40/2.65	2.36/2.56	2.34/2.51
13.5	2.56/2.93	2.47/2.80	2.40/2.68	2.36/2.61	2.32/2.53	2.30/2.48
14	2.53/2.90	2.44/2.77	2.36/2.65	2.32/2.58	2.28/2.50	2.25/2.44

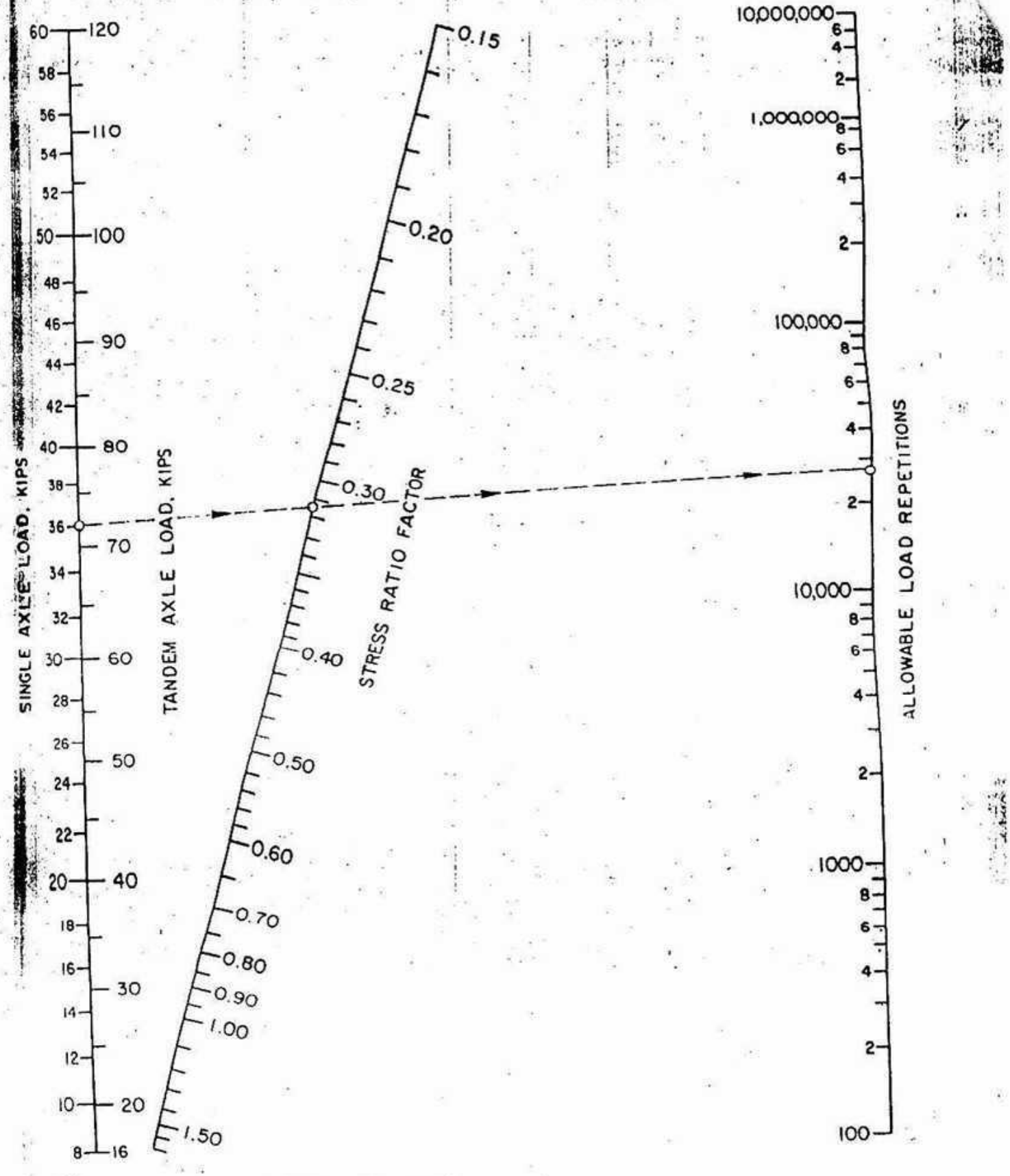


Fig. 5. **Fatigue analysis—allowable load repetitions based on stress ratio factor (with and without concrete shoulder).**

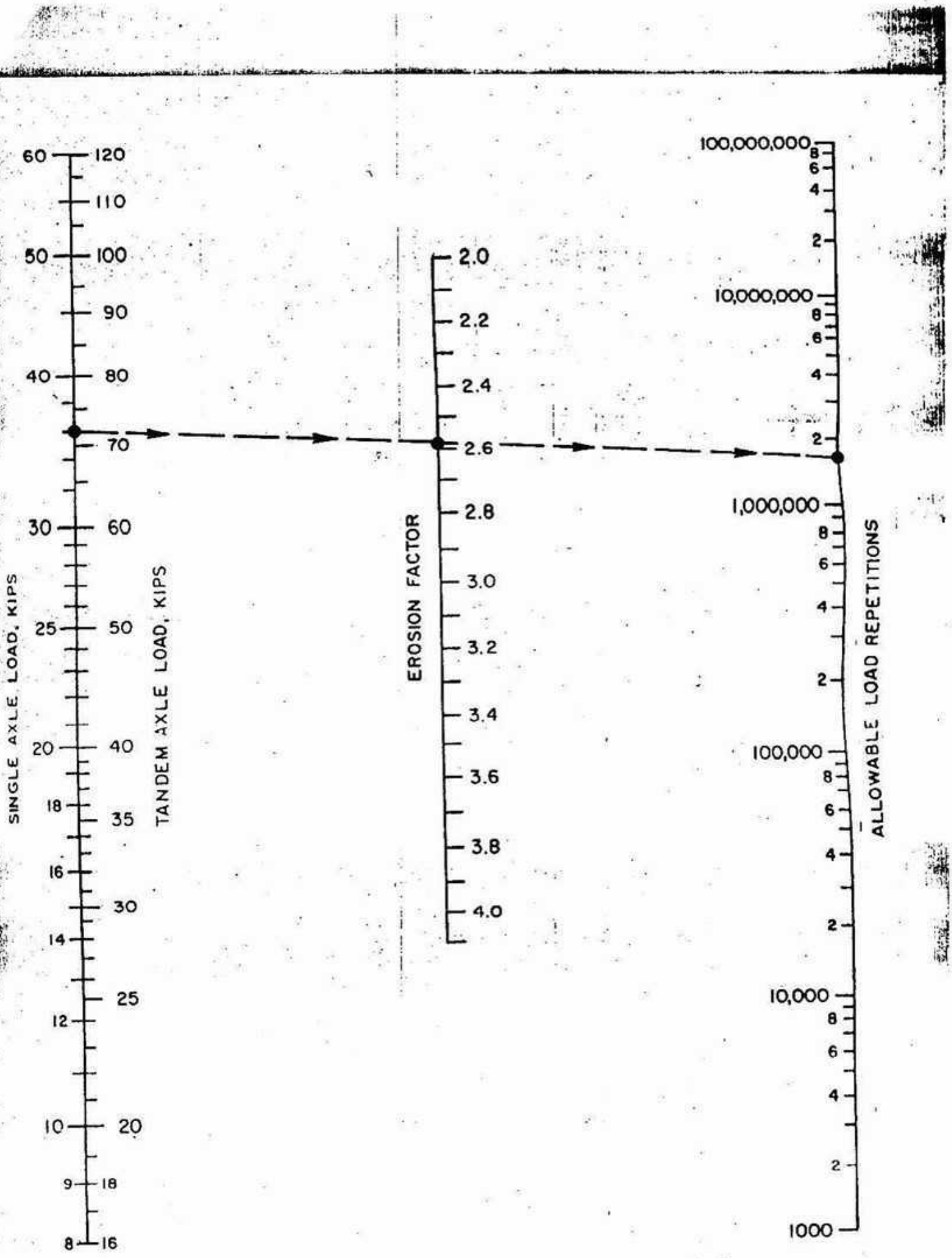


Fig. 6a—Erosion analysis—allowable load repetitions based on erosion factor (without concrete shoulder).

NOMOGRAPH SOLVES:

$$\log_{10} W_{18} = Z_R \cdot S_o + 9.36 \cdot \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 \cdot \log_{10} M_R - 8.07$$

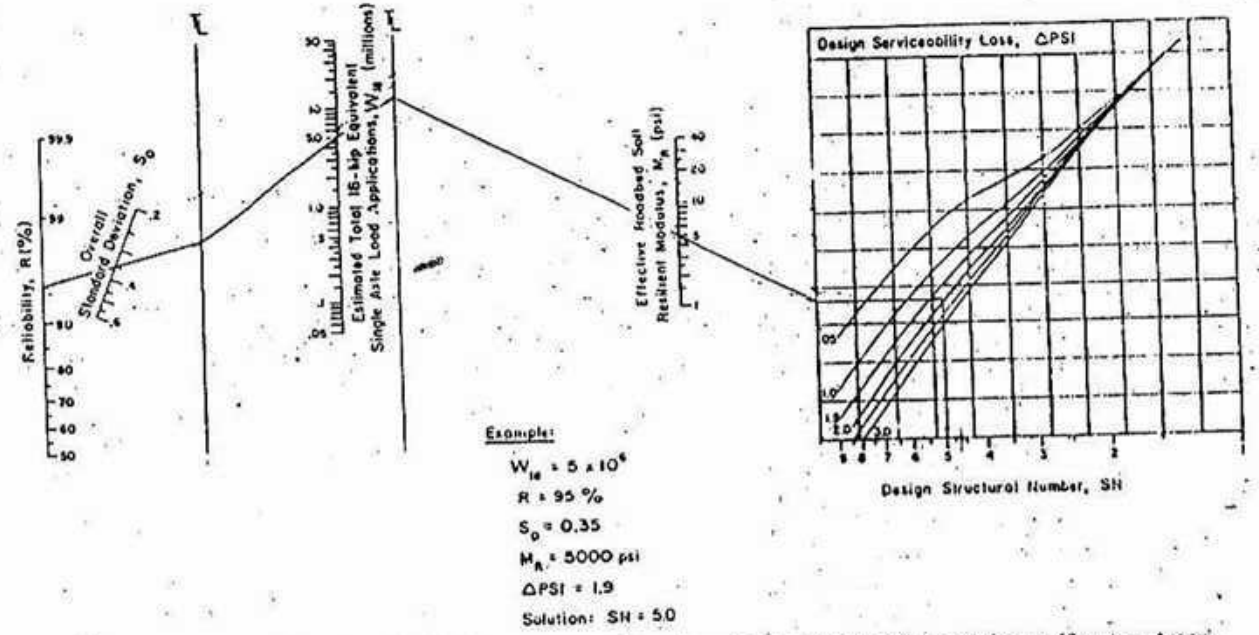


FIGURE 16-11 AASHTO design chart for flexible pavements based on using mean values for each input. (Courtesy American Association of Highway and Transportation Officials.)

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Irrigation and Flood Control | Course Code: CE 461

Time: 3 hours | Full Marks: 150

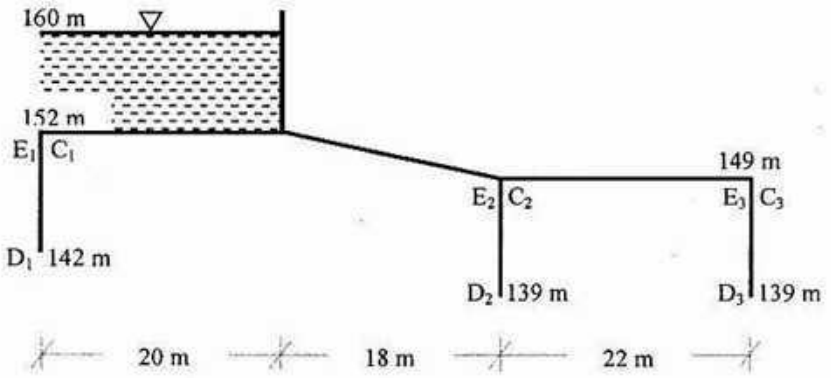
SECTION A

Answer Question No. 1 and any THREE from the rest

(Assume any reasonable data if not given)

1. (a) Distinguish between the following (any four) (16)
   (i) Attracting and repelling groyne
   (ii) Efficiency of water storage and water use
   (iii) Aqueduct and siphon aqueduct
   (iv) Bligh's and Lane's theory
   (v) Free flooding and Border flooding
   (vi) Contour canal and watershed canal

   (b) Use Khosla's curves to calculate the percentage uplift pressure at points C_1, E_2, C_2, D_3 and E_3 for a barrage foundation profile shown in figure below applying necessary corrections. Also determine the exit gradient. [Assume: floor thickness = 1 m] (18)



Slope (H : V)	Correction Factor
1 : 1	11.2
2 : 1	6.5
3 : 1	4.5
4 : 1	3.3
5 : 1	2.8
6 : 1	2.5
7 : 1	2.3
8 : 1	2.0

2. (a) Discuss about the optimum utilization of irrigation water. Describe sprinkler irrigation method along with its advantages and disadvantages. (4+6)

(b) Why diversion of head works is needed? What are the components of diversion of head of works? Draw the layout of diversion of head works. (6)

(c) The culturable command area for a distributary is 15,000 hectares. The intensity of irrigation is 40% for Rabi and 10% for rice. Outlet factor for Rabi and rice may be assumed as 1800 ha/m^3/sec and 775 ha/m^3/sec respectively. What is the design discharge at distributary head at 10% conveyance loss? (6)

3. (a) What is cross-drainage works? Explain its necessity. (2+4)

(b) Explain four causes of failure of hydraulic structures. (7)

(c) An unlined canal having a seepage loss of 3.5 cumec per million square meters of wetted area and 2 km length is proposed to be lined with 12 cm thick cement concrete lining, which costs Tk. 20 per square meters. Given the following data, work out the economics of lining and benefit cost ratio. (9)

Annual revenue per cumec of water from all crops = Tk. 3.5 lakhs
Discharge in the channel = 60 cumecs
Cross-sectional area of the channel = 45.8 m^2
Wetted perimeter of the channel = 20 m
Total inclined length of the wetter surface = 12.5 m
Bottom width of the wetted surface = 7 m
Annual maintenance cost of unlined channel for 2 km = Tk. 3000
Life time of channel = 50 years
Rate of interest = 10%

4. (a) Explain soil-water relationship. Explain its importance to make an economical irrigation canal. (5)

(b) Write the purposes of marginal bunds. (3)

(c) What are the important aspects need to be included in an irrigation project report? Define canal system along with his components. (4+3)

(d) A Persian wheel discharges at the rate of 11,000 litres per hour and works for eight hours each day. Estimate the area commanded by the water lift if the average depth of irrigation is 8 cm and irrigation interval is 15 days. (7)

5. (a) Distinguish between Montague fall and Inglish fall with sketch. (5)

(b) Distinguish between drop spillway and ogee spillway. (5)

(c) What types of place are suitable for selecting diversion head works? (4)

(d) Design the shape of an ogee spillway for the following data (8)

Maximum head over the crest = 5 m
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.

SECTION B

Answer Question No. 6 and any THREE from the rest

6. (a) Define flood and flood management. What are the objectives of flood management? (3+4)

   (b) What are the key elements of IWRM process? (7)

7. What are the types of measures of flood management? Distinguish between them. Write down the methods of flood management under each type. (2+3+7)

8. Explain the following (any three) (3×4)

   (a) Sustainable development

   (b) Embankment

   (c) Flood proofing and flood protection

   (d) Salinization

   (e) Polder

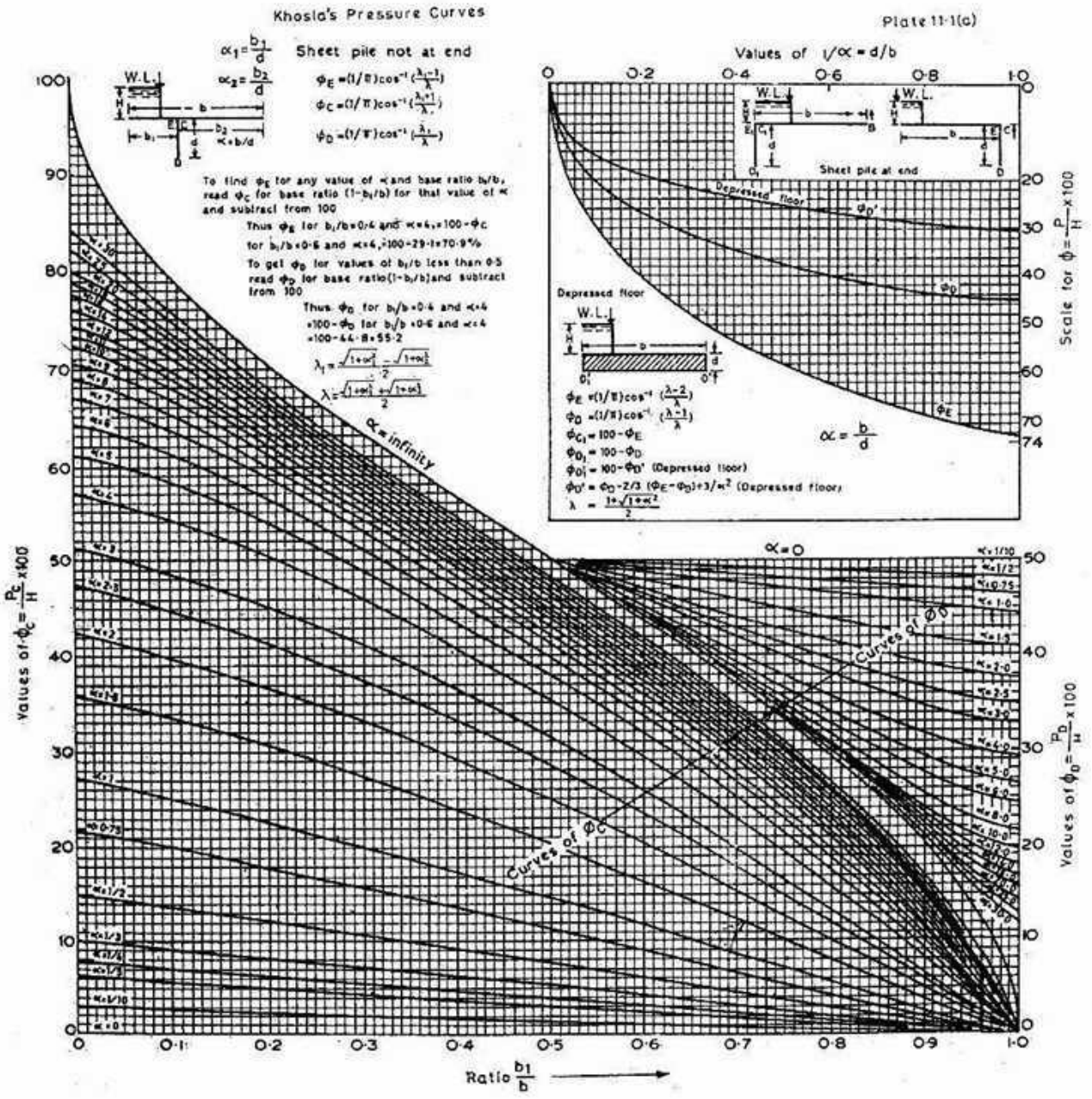
9. Write down the FAP guiding principles of flood management. (12)

10. What is water logging? What are the causes of water logging? How can you control water logging? (3+4+5)

11. (a) What is leaching requirement? (2)

    (b) Estimate the required depth of irrigation water to be applied to the field if the leaching requirement is 6% and consumptive use requirement of the crop is 80 mm. (4)

    (c) What are the sources of irrigation water? Give examples of some manual irrigation water lifter. (2+4)


Khosla's Pressure Curves
Plate 11·1(c)
Sheet pile not at end
Values of 1/∝ = d/b
Sheet pile at end
Depressed floor
To find ϕ_E for any value of ∝ and base ratio b_1/b, read ϕ_C for base ratio $(1-b_1/b)$ for that value of ∝ and subtract from 100
Thus ϕ_E for b_1/b = 0·4 and ∝ = 4, = 100 − ϕ_C
for b_1/b = 0·6 and ∝ = 4, = 100 − 29·1 = 70·9 %
To get ϕ_D for values of b_1/b less than 0·5 read ϕ_D for base ratio $(1-b_1/b)$ and subtract from 100
Thus ϕ_D for b_1/b = 0·4 and ∝ = 4
= 100 − ϕ_D for b_1/b = 0·6 and ∝ = 4
= 100 − 44·8 = 55·2
∝ = infinity
∝ = 0
Curves of ϕ_D
Curves of ϕ_C
Values of $\phi_C = \frac{P_C}{H} \times 100$
Values of $\phi_D = \frac{P_D}{H} \times 100$
Scale for $\phi = \frac{P}{H} \times 100$
Ratio $\frac{b_1}{b}$

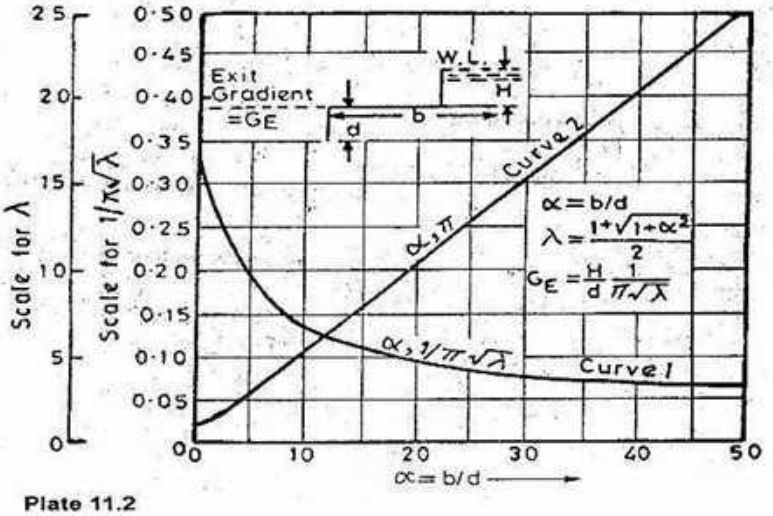

Exit Gradient = GE
W.L.
H
d
b
Curve 2
Curve 1
∝ = b/d
$\lambda = \frac{1+\sqrt{1+\alpha^2}}{2}$
$G_E = \frac{H}{d} \frac{1}{\pi\sqrt{\lambda}}$
Scale for λ
Scale for $1/\pi\sqrt{\lambda}$
∝ = b/d

Plate 11.2

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Chemistry | Course Code: CHEM 111
Time: 3 Hours | Full Marks: 150

[THIS QUESTION IS DIVIDED INTO TWO SECTIONS, SECTION A AND SECTION B. ANSWER 3 QUESTIONS FROM EACH SECTION]

Section-A

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

1. (a) What is internal energy (E)? **5**
Show graphically how internal energy changes endothermically and exothermically in the chemical reactions.

(b) Explain the term enthalpy (H). **10**
Derive thermodynamically the Kirchhoff's equation.

(c) What is heat of combustion? **10**
Draw and describe a bomb calorimeter used for the determination of heat change in the combustion of octane fuel.

2. (a) What is associated liquid? **5**
Draw and explain the associated structure of water.

(b) What is water of crystallization? **10**
Explain that NH_3 dissolves in water very easily whereas CH_4 do not.
Discuss the chemical action of water with metal carbides.

(c) Differentiate between hard water and heavy water. **10**
Discuss the preparation and exchange reactions of heavy water.

3. (a) A solution is not always be said a homogeneous system – explain. **5**
How does a solution conflict with the concept of a compound?

(b) What is super saturated solution (SSS)? **10**
Describe the preparation and important characteristics of SSS.

(c) What is solubility curve? Draw and explain different types of solubility curves. **10**
Show that solubility of a solid in liquid is constant at a constant temperature.

4. (a) What is reaction rate? Distinguish between instantaneous and average rates. **5**

(b) Define order and molecularity. How molecularity differs from order? **10**
Classify molecularity based on chemical reactions.

(c) State rate law and half-life ($t_{½}$) of a reaction. Derive expressions for integrated rate law and $t_{½}$ of a first order reaction. **10**
For a certain first order reaction, $t_{½}$ is 100s. How long will it take for the reaction to be completed 75% ?

Section-B

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

5. (a) What is colloidal dispersion? Compare it with a true solution. **5**

(b) What is meant by lyophobic colloid? **10**
Describe the Bredig's Arc method for the preparation of lyophobic colloids.

(c) How a solution can be purified by electrodialysis method? **10**
Explain the Tyndall effect and Brownian movement exhibited by the sols.

6. (a) What is NOx? **5**
Name the common ions, radicals and particles present in the atmosphere.

(b) Discuss the photochemical and chemical reactions taking place in the atmosphere for the formation of acid rain and organic compound that reduces visibility. **10**

(c) What is ozone layer? **10**
Discuss the chemical phenomenon involved in the formation and depletion of ozone layer.

7. (a) What is oligopolymer? How does it differ from a high polymer? **5**

(b) Describe the thermoplastic and thermosetting polymers. **10**
Show the chemical reactions for the synthesis of nylon 66.

(c) Discuss the mechanism for the chain reaction of polymerization. **10**
How PVC and Orlon can be prepared by chain reaction polymerization?

8. (a) What is dry corrosion? **5**
How does dry corrosion occur with the Cr and W metals?

(b) Explain the blistering and decarburization of metals by hydrogen. **10**
Show chemical reactions for the corrosion of Ag and Fe metals with Cl_2 and H_2S gases.

(c) Discuss the physico-chemical aspects of: **10**
i) Under water corrosion and
ii) Microbiological corrosion.

University of Asia Pacific
Department of Civil Engineering
Semester Final Examination, Fall - 2011
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) State the following laws: [6]
   (i) Ohm's Law
   (ii) Kirchhoff's Voltage Law (KVL)
   (iii) Kirchhoff's Current Law (KCL)

   (b) Calculate the value of the unknown resistor, R in the Fig.1 (b). [10]

   (c) Show that for the circuit in Fig. 1(c), $V_1 = \frac{R_1}{R_1+R_2}.V_s$ and $V_2 = \frac{R_2}{R_1+R_2}.V_s$ [9]

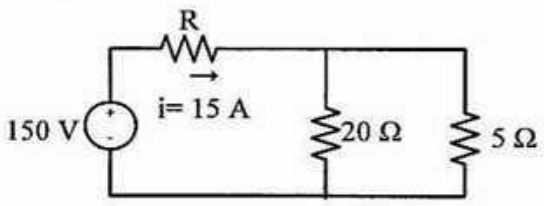


Fig.1 (b)

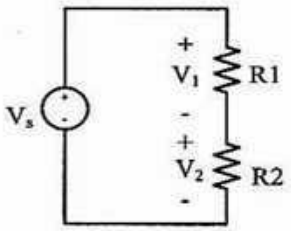


Fig. 1(c)

2. (a) Use Nodal analysis to find i_1 and i_2 in the circuit shown in Fig.2(a) [10]

   (b) Using Nodal analysis find V and i for circuit shown in Fig.2(b) [15]

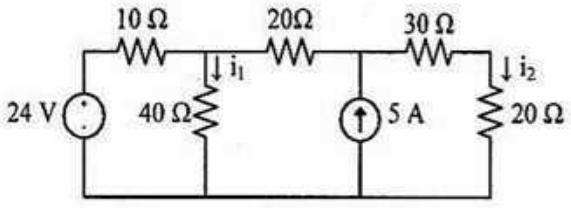


Fig. 2(a)

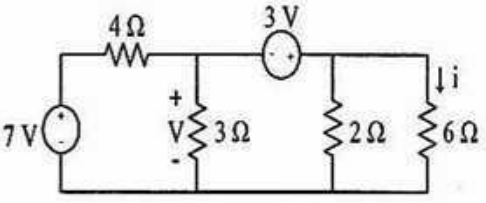


Fig. 2(b)

3. (a) What is a supermesh? Draw a network containing a supermesh. [7]

   (b) Using Mesh Circuit analysis find i_1, i_2 and i_3 in the circuit shown in Fig.3(b) [18]

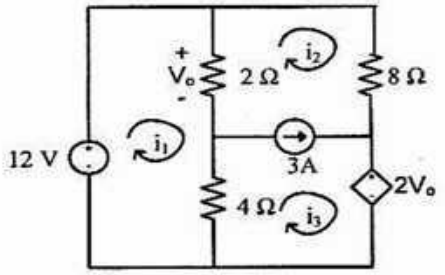


Fig. 3(b)

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.

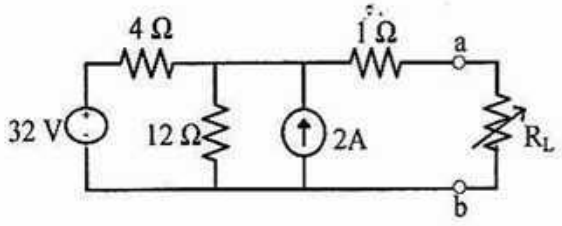


Fig. 4(b)

5. (a) State Maximum Power Transfer Theorem and prove it. Also find the expression of maximum power transferred to the load. [12]

(b) Determine the value of R_L that will draw maximum power from the rest of circuit shown in Fig.5(b). Calculate the maximum power. [13]

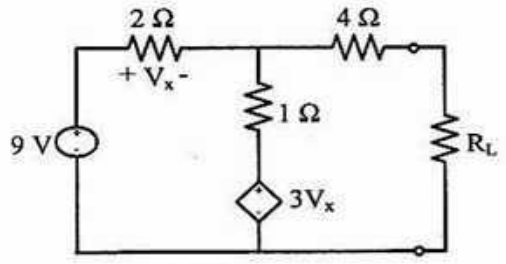


Fig.5(b)

6. (a) State superposition theorem. [5]

(b) Using superposition principle find i_0 the circuit shown in Fig .6(b) [20]

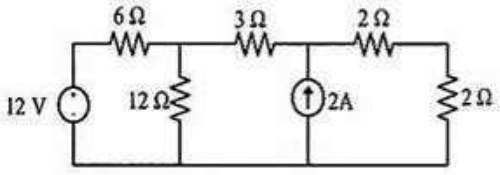


Fig. 6(b)

7. (a) Calculate phase angle between $V_1 = -10\cos(wt + 50^\circ)$ and $V_2 = 12\sin(wt - 10^\circ)$. Which sinusoid is leading? [10]

(b) Find R.M.S voltage of following Sinusoidal voltage shown in Fig.7(b) [15]

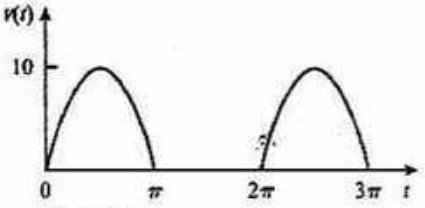


Fig. 7(b)

8. (a) Calculate Z_{in} at $w = 10$ rad/s. for circuit shown in Fig. 8(a) [10]

(b) Calculate Vo as indicated in the following Fig. 8(b) [15]

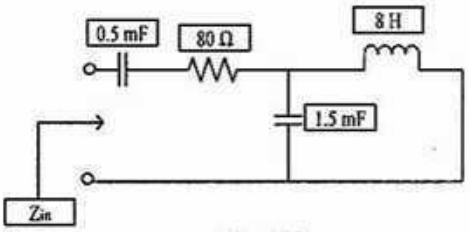


Fig. 8(a)

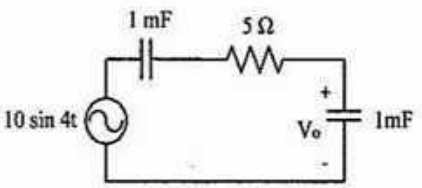


Fig. 8(b)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B. Sc. Engineering (Civil)

Course Title: Principles of Economics | Credit Hours: 2.0 | Course Code: ECN 201
Time: 2 hours | Full Marks: 50 (= 5 × 10)

Answer any 5 (FIVE) of the following six Questions (No. 1~6)

1. a) Discuss the concept and use of 'marginal production' in the context of production analysis of a firm. *[5+5]*
   b) Discuss the 'law of diminishing marginal return'.

2. a) Describe the relations between/among different types of cost concepts used in production analysis. *[6+4]*
   b) Distinguish between economic cost and accounting cost.

3. a) Portray your understanding on the concept of 'macroeconomics', with special emphasis on macroeconomic objectives and policies. *[6+4]*
   b) How does the government of a country attempt to reach the macroeconomic objectives?

4. a) What is market equilibrium? Describe the states of disequilibrium. Explain with figures. *[6+4]*
   b) Consider the demand and supply functions as $Q^d = 400 - 3p$ and $Q^s = 150 + 2p$.
   Find the equilibrium price and quantity.

5. a) Describe the 'law of Demand' with some of its exceptions. *[5+5]*
   b) When price of a commodity increases from Tk. 12 per unit to Tk. 15 per unit, its demand falls from 1200 units to 800 units.
   Calculate the price elasticity of demand and comment on the result.

6. Write short notes on any FOUR of the followings *[2.5 × 4]*
   a) Determinants of demand
   b) Return to scale
   c) Inflation
   d) Macroeconomic markets
   e) Unemployment.

University of Asia Pacific
Final Examination Fall 2011
Programmes: Arch, BBA, CSE, EEE, Pharmacy

Course Code: HSS 101 | Course Title: English Language I
Time: 3 hours | Full Marks: 50

Section – A

1. *Read* the passage *carefully* and *then* answer the *corresponding questions*.

While I was walking along the road the other day I happened to notice a small brown leather purse lying on the pavement. I picked it up and opened it to see if I could find out the owner's name. There was nothing inside except some small change and a rather old photograph – a picture of a woman and a young girl about twelve years old, who looked like the woman's daughter. I put the photograph back and took the purse to the police station, where I handed it to the sergeant in charge. Before I left, the sergeant made a note of my name and address in case the owner of the purse wanted to write and thank me.
On that evening, I went to have dinner with an uncle and aunt of mine. They had also invited another person, a young woman, so that there would be four people at the table. The young woman's face was familiar, but I could not remember where I had seen her. I was quite sure that we had not met before. In the course of conversation, however, the young woman happened to remark that she had lost her purse that afternoon. I at once remembered where I had seen her face. She was the young girl in the photograph, although she was now much older. Of course she was very surprised when I was able to describe her purse to her. Then I explained that I had recognised her face from the photograph I had found in the purse. My uncle insisted on going round the police station immediately to claim the purse. As the police sergeant handed it over, he said that it was remarkable coincidence that I had found not only the purse but also the person who had lost it.

A. Trace out if the statements are true or false. *If true, write T* and *if false, write F* and *provide* correct answers. **5×0.5=2.5**

a. The writer was walking with his friends in the streets when he had found the purse.
b. The colour of the purse that the writer had found was brown.
c. The purse had only a photograph in it when the writer had found it.
d. The writer met the owner of the purse and recognised her immediately.
e. The police sergeant came to the writer to return the purse.

B. Vocabulary. **5×0.5=2.5**

a) When somebody ***happens*** to notice something, s/he
   1. makes things happen
   2. sticks a notice in the notice board
   3. notices something rather suddenly
   4. observes something casually

b) ***Pavement*** is
   1. where little children play in the afternoon
   2. the part of a road where vehicles are parked
   3. a flat part on the side of a road for people to walk on
   4. the road itself

c) A ***photograph*** is
   1. a collection of colours
   2. a colour spectrum
   3. a visual memory
   4. a painting

d) When something looks ***familiar***, that means
   1. it is something completely unknown
   2. it is a family affair
   3. it is too much expensive-looking
   4. it is well known to you

e) When you ***insist***
   1. you go on a protest for your rights
   2. you look for someone
   3. you demand something to happen
   4. you instantly remember something

Section B

2. Fill in the blanks with appropriate parts of speech (*any three*). 3×2=6

1. We had to halt at the _____ (stop) nearby as it started raining _____ (sudden).
2. Rudro argued _____ (logic) but Taher was declared the winner _____ (final).
3. Electric Bulb, which is an _____ (invent) by Thomas Alva Edison, is _____ (remark).
4. 21st February, 1952 reminds us of the _____ (glory) history of struggle and _____ (resist) of the language movement.

3. Add either a prefix or a suffix given in brackets (Over-, Un-, Re-, Dis-, For-, Il-, Mis-, -full, -less, -ly, -ing, -ence) with *any ten* of the following base words and make a sentence with each of the new words. *[Do not repeat any of the prefix/suffix or word]* 10×0.5=5

Form, Lodge, Care, Logical, React, Effort, Swim, Bold, Match, Ever, Occur, Relax

4. Write *two sentences* for each with *any four* of the following words giving their two different meanings. 4×1=4

Sentence, Admit, Desert, Brief, Leave, Kind, Row

5. Write *two sentences* with *any four* of the following words and their homophones. 4×1=4

Fair, Weak, Wright, Knot, Wait, Flower, Roll

6. The following excerpt has some *misspelled words*. *Trace* them out and *write* them *correctly*. 10×0.25=2.5

Butterfliès are one of the most beautyful and intersting creatures on Earth. A butterfly garden is an easy way to see more butterflies and to help them, since many natural butterfly habitets have been lost to human activityes like building homes, roads and farms. It is easy to increase the number and varity of butterflies in your yard. By planting a butterfly garden with all of the right kinds of plants and flouers that

butterflies love to feed on and lay eggs on, you will certainly have a yard full of butterflies thruout the growing seazon. Butterfly gardens can be any size. It can be a window box, part of your landscaped yard, or even an open wild area on your property. Seemply grow the plants that the caterpilars like to eat and plants that adult butterflies feed on!

7. *Transcribe* the following words putting in the *vowel sounds only*. **5×0.5=2.5**

Map	/m _ p/
Moon	/m _ n/
Thin	/Θ _ n/
Lake	/l _ _ k/
Shy	/ʃ _ _/

Section C

(Answer *any three* of the following questions. *Each question* carries *7 marks*) **3×7=21**

8. Compare and contrast any two fairs you have recently visited. (250 words)
9. Describe a winter morning in a village where you have been. (250 words)
10. Write a letter to your friend about your first semester at UAP. (250 words)
11. Translate the following passage into English.

একদিন মাহবুব পায়ে হেটে স্কুলে যাচ্ছিল। পথে সে একটি নাম না জানা হলুদ রঙের পাখি দেখতে পেল। তার খুব ইচ্ছে হল পাখিটিকে তার নাম জিজ্ঞেস করে। কিন্তু পাখিটি উড়ে গেল। মাহবুবের মন খারাপ হয়ে গেল। সে স্কুলে গিয়ে সারাদিন পাখিটির কথা ভাবলো। এমনকি এক স্যার তাকে জিজ্ঞেস করলেন, "কী হয়েছে মাহবুব?" উত্তরে সে বলল, "কিছু না, স্যার।" রাত্রে মা ও করলেন একই প্রশ্ন। মাহবুব আবারো বলল, "কিছু না, মা।" সেই রাত্রে মাহবুব ঘুমের মাঝে হলুদ পাখিটিকে দেখতে পেল। পাখিটি বলল, "তুমি আমার নাম জানতে চাও? আমার নাম মাহবুব।" মাহবুব জিজ্ঞেস করল, "তুমি আমার বন্ধু হবে?" পাখিটি বলল, "আমরা তো বন্ধুই।" মাহবুব ঘুমের মাঝেই একটা মিষ্টি হাসি দিল।

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II — Course Code: CE 333
Time: 3.0 hours — Credit: 3.00 — Full Marks:100(=40+20×3)

[There are 6 questions. Answer Question 1 (compulsory) and any 3 (Three) from the rest]

[Assume any data, if missing]

1. ***(Answer any 20 out of the following 26 questions)*** (20×2 = 40)

(a) How the role of environmental engineers differs with structural engineers?

(b) What problem arises if water hyacinth grows in stabilization pond?

(c) Define sludge and mention different types of sludge depending on the degrees and method of treatment.

(d) Define Sewer, Sewage, Sewerage and Sewage effluent.

(e) Describe Algae-Bacteria symbiosis.

(f) How strong sewage affects the dissolved oxygen level in a stream?

(g) List the factors that influence sedimentation.

(h) Enumerate different type of stabilization pond and mention their main functions in sewage treatment.

(i) Why optimum retention period is considered as 5 days in an anaerobic pond?

(j) What measures are taken for odor control in anaerobic pond?

(k) What are the most commonly used depth for different stabilization ponds?

(l) Mention the methods commonly known as to contribute O_2 to surface water.

(m) What are the disadvantages of sewage effluent disposal by irrigation?

(n) Briefly describe AWWF and ADWF.

(o) Describe zone of recovery as a stage of water pollution and self purification.

(p) What measure is adopted for handling the chemical hazards in PSTP?

(q) Write about application and suitability of waste stabilization pond?

(r) How layout of water supply pipe differs with sewage collection pipe in Dhaka city?

(s) Why fungi are important in biological treatment?

(t) How algae affect pH change in a water body in different time of a particular day?

(u) What are the applications of BOD data in sanitary engineering practices?

(v) Classify Bacteria depending on their shapes, need for oxygen and metabolism?

(w) Why zoning is important for water supply in a tall building? Mention different zones.

(x) What type of Bacteria is more suitable for sewage treatment? Justify your answer.

(y) In Dhaka city, which type of zoning is generally considered in water supply pipe design?

(z) Define the suspended and attached growth processes. Give some examples of these treatment processes.

2. **(a)** What are the objectives of plumbing system, water supply system and drainage system? 6

(b) Explain- (i) MLSS, (ii) Invert level of sewer, and (iii) Self Cleansing Velocity. 6

(c) Why is circular sewer section preferred to other sections? 4

(d) Sketch the water supply system for a tall building. 4

3. **(a)** Discuss the solid removal mechanism in imhoff tank (with diagram). 6

(b) What are the conditions to be fulfilled for an ideal drain section? Draw the typical cross sections of an inclined bottomed and a trapezoidal round bottomed drain. 6

(c) A sample of sewage was incubated for 3 days and the BOD of the sample was observed to be 165 ppm at 20^0C. Determine its 5-day 20^0C and 10 day 20^0C BOD values. Assume $k_1(20^0C) = 0.1\ d^{-1}$ 4

(d) Calculate the sludge volume index (SVI) for a mixed liquor with 2,500 mg/L of suspended solid when a lifer of such mixed liquor produces 190 mL of sludge when settles down. 4

4. **(a)** Show diagrammatically the form of biological process in a Trickling filter. 6

(b) An average operating data for conventional activated sludge treatment plant is as follows: 5

Waste water flow	= 35 MLD
Influent BOD	= 250 mg/l
MLSS	= 2,500 mg/l
BOD loading	= 90 gms per 200 gms of Suspended Solid
Return sludge	= 20 %

Based on the information above, design the aeration tank. [hints: Find V, t]

(c) Write some relative advantages of activated sludge over trickling filters? 4

(d) A 5 ft deep, 0.5 acre tricking filter has been constructed to treat 1 mgd of sewage having a BOD_5 of 200 mg/L for a small town. Calculate the BOD concentration in filter effluent when the recirculated rate is 58 percent of the flow. [Use Eckenfelder's formula] 5

5. **(a)** Draw bacterial growth pattern and briefly discuss with respect to F/M ratio and settlement of bacteria colony. 6

(b) What are the methods of disposal for sewage effluent on land by irrigation? 2

(c) Design a facultative and maturation pond system for treating sewage from a hot climatic residential colony of 5000 persons with contributing sewage of 120 lpcd. The BOD_5 of sewage is 300 mg/l and the amount of FC (fecal coliform) is 4×10^7 FC/ 100 ml. The design temp is 20°C and the required effluent standards are: $BOD_5 < 25$ mg/l, FC < 5000/100 ml. Assume the values of k and k_b are 0.3 d^{-1} and 2.5 d^{-1} respectively. 12

6. **(a)** Draw the typical pattern of pollution and self purification of a severely polluted stream and its effect on biological life of bacteria and DO concentration in that stream. 6

(b) What are the factors that influence pollution and self-purification process in a stream? 2

(c) A municipal wastewater treatment plant discharges secondary effluent to a surface stream. The worst conditions are known to occur in the summer months when stream flow is low and water temperature is high. Under these conditions, measurements are made in the laboratory and in the field to determine the characteristics of the wastewater and stream flows. The wastewater is found to have a maximum flow rate of 15,000 m^3/day, a BOD_5 of 40 mg/l, a DO concentration of 2 mg/l and a temperature of 25 °C. The stream (upstream from the point of wastewater discharge) is found to have a minimum flow rate of 0.5 m^3/s, a BOD_5 of 3 mg/l, a DO concentration of 8 mg/l and a temperature of 22°C. Complete mixing of wastewater and stream is almost instantaneous and the velocity of the mixture is 0.2 m/s. From the flow regime, the BOD reaction and reaeration rate constants are estimated to be 0.23 day^{-1} and 0.24 day^{-1} respectively for 20°C condition. Determine- 12

(i) The critical (minimum) DO and its location.

(ii) The DO at 75 m and 75 km downstream point of discharge of the sewage.

Formula:

1. $A = \frac{Q}{DK}\left(\frac{L_i}{L_e} - 1\right)$ and $A = \frac{Qt}{D}$

2. $\frac{L_e}{L_f} = \frac{1}{1+2.5\frac{D^{0.6}}{Q^{0.5}}}$ and $L_f = \frac{L_i + RL_e}{R+1}$

3. $\frac{L_e}{L_i} = \frac{1}{1+k_1 t}$ and $N_e = \frac{N_i}{(1+k_b t_1)(1+k_b t_2)....(1+k_b t_n)}$,

4. $D_t = \frac{K_1 L_a}{K_2 - K_1}\left(e^{-K_1 t} - e^{-K_2 t}\right) + D_a . e^{-K_2 t}$ and $D_c = \frac{K_1}{K_2} L_a . e^{-K_1 t_c}$

5. $t_c = \frac{1}{K_2 - K_1} \ln\left\{\frac{K_2}{K_1}\left(1 - \frac{D_a(K_2 - K_1)}{K_1 L_a}\right)\right\}$

6. $K_{1(T)} = K_{1(20)} \times (1.047)^{T-20}$ and $K_{2(T)} = K_{2(20)} \times (1.016)^{T-20}$

7. $\lambda_s = \frac{10\, L_i\, Q}{A}$ and $\lambda_{s(all)} = 20T - 120$

University of Asia Pacific
Department of Architecture/ Business Admin/ CE/ CSE/ Pharmacy
Final Examination Fall-2011
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

1. Read the following passage and answer the questions that follow:

The modern ideas are beginning to influence the Eskimos, but not enough to make much difference to their way of life. They still spend the winter in igloos, the round huts that are built of snow frozen hard. They still travel on sleds that are pulled by dogs. The winter is too cold for hunting, so during that season they live on the stores of seal meat that they have killed in the summer. But seal meat is not the only kind of food that they eat. In summer they hunt reindeer and bears. They also fish all the year round. The Eskimos who are hunters in summer are fishermen in winter. In winter they make holes in the ice and catch their fish through the holes that have made. Eskimos live in very difficult conditions. There is not enough wood to make furniture and there is no metal for tools. They use bone, therefore, for their fish hooks and tips of their arrows. Only adaptable workmen can live in these conditions. The Eskimos are adaptable. That is why they are able to live in the Arctic lands.

a) Answer any **six** of the following questions: **1×06=06**
   1) Do the Eskimos live in the north or in the south of the world?
   2) What do we call the regions where they live?
   3) How do they spend the summer?
   4) How can they catch fish when the water is frozen?
   5) Why do they keep dogs?
   6) What is an igloo?
   7) What do they use for making their fish hooks or tips of arrow?
   8) How are they able to live in Arctic lands?

b) Fill in the blanks with *by, for, in, of, to, on* : **0.5×08=04**

   1) The Eskimos get their food ____hunting and fishing.
   2) ____ winter they live ___ seal meat.
   3) They use bone ___ fish hooks and the tips of arrows.
   4) The life____ the Eskimos is primitive.
   5) The Eskimos live all the winter _____ igloos.
   6) The Eskimos are able ___ live in the Arctic lands because ____ their adaptability.

2. Rewrite any **ten** of the following sentences using appropriate modal verbs: **0.5×10=05**
   a) You are permitted to sit for the exam.
   b) There is a possibility of raining today.
   c) He is able to do magic tricks.
   d) It is suggested that you go home early.
   e) I am obliged to obey my teachers.
   f) Mr. Rahman has necessity to see an eye specialist.
   g) Do you allow me to use your computer please?
   h) They did not get the permission of not doing the class today.
   i) I advise you to be more attentive.
   j) He has the obligation to go home immediately as his father is ill.
   k) My father was able to play chess in his student-life.
   l) My doctor advised me to take foods containing calcium.

3. Join any **ten** of the following pairs of sentences with appropriate **conjunctions** or **relative pronouns**. Do not use the same joining words more than once: **0.5×10=05**

a) My foot was injured. I could not manage to walk the nearest village.
b) Rony is attaining the class. He is very ill.
b) We live in the same street. We hardly meet each other.
c) I was tired last night. I went to bed early.
d) The baby fell asleep. I was watching television.
e) I met a lady yesterday. She writes poetry.
f) I love travelling. It broadens our knowledge about the world.
g) My sister is a singer. She is a guitarist.
h) I recently went back to the small town. I grew up there.
i) The woman lives next door. She is a doctor.
j) I went to my friend's office. I did not find him there.
k) The girl does not respond much in the class. She is very sincere.
l) I have written down what you said. You may forget.

4. Write single sentence definition any **five** of the following words: **01×05=05**

a) I-pod (description) b) Generous (negation) c) Stadium (function) d) Orchid (class)
e) Humble (synonym) f) Vegetarians (class) g) Library (function)

5. Write a letter to the Registrar of your university seeking permission for forming a music club.
Or, Write a letter to your sister describing the annual picnic of your department. **05**

6. UAP will participate in the national spelling competition 2012. As the convener of UAP Programming Club, write a memorandum to this effect. **05**

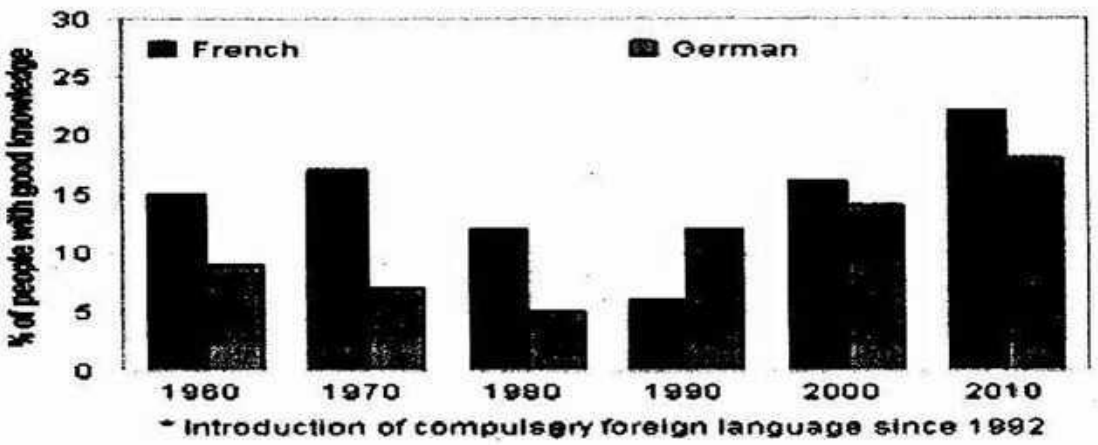
7. UAP recently organized 1st 'Inter-departmental Debate Championship-2012'.As a reporter of a national daily, write a news-report on the event for publication in your newspaper. **05**

8. Write a paragraph on any **one (1)** of the following topics (word limit 130 words) **05**

a) My Favourite Personality b) Ekushey Boimela c) A Moment of Success

9. The bar chart below shows information about introduction of compulsory foreign language at Oxford University since 1992. Describe and analyze the information available in the chart in your own words.**05**

Introduction of compulsory foreign language at Oxford University since 1992



University of Asia Pacific

Department of Basic Sciences and Humanities

Final Examination, Fall 2011

Programmes: B.Arch. and B.Sc. Engineering (Civil, Computer Science, Electrical and Electronic)

Course Title: Bangladesh Studies: Society and Culture **Course Code: HSS 111(a)**
Credit: 2.00 **HSS 211(a) [for CE]**

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** (4x20)

1. 'Land and Power' are the influential elements of rural stratification pattern of Bangladesh. Which element has lost its influence at present?
2. Discuss in brief the economic arrangements in the pre-industrial and industrial stages of human society.
3. Define political institution. What are the general functions of a government? Discuss with example on the types of government.
4. Identify the problems that arise as a result of rural-urban migration and urbanization in the underdeveloped country like Bangladesh.
5. What is culture? Highlight the characteristics of the society and culture of Bangladesh.

SECTION B

There are **THREE** questions in this section. Answer **ANY TWO** (2x10)

6. What are the different forms of marriage and family?
7. Discuss the family functions.
8. Discuss on the ethnic (tribal) groups of Bangladesh.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2011
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 8 (EIGHT) questions. All questions are of equal value.

1. How would you define & explain "Management". How do the required managerial skills differ in the organizational hierarchy? What are the management functions?

2. Define objectives. Discuss the relationship between objectives and the organizational hierarchy. Describe MBO process.

3. Define & explain staffing. Discuss the functions of HRM. Identify the principles of HRM.

4. What is organization? What do you mean by formal and informal organization? How authority is delegated and what are the processes of delegation?

5. What is Motivation? State briefly Maslow's theory of motivation. Discuss the main steps of motivation.

6. What is meant by controlling? Discuss the basic control process. State different types of budgetary and non-budgetary control devices.

7. What is planning? Identify various types of plans. Discuss the steps in planning.

8. Write short note on **any four** of the following:
   (a) Decision making
   (b) Ethics in Business
   (c) Leadership
   (d) Time Management
   (e) MIS

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination Fall 2011
Program : B.Sc Engineering (Civil)

Course Title: Mathematics I | Credit Hour: 3.00 | Course Code: MTH 101
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**.

Q1. (a) Define successive differentiations with examples. Find the nth derivative of $y = \cos(ax + b)$. 12.5

(b) State and prove Leibnitz's theorem. If $y = (\sin^{-1} x)^2$, then show that 12.5

$$(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2 y_n = 0.$$

Q2. (a) State and prove Rolle's theorem. 12.5

(b) Verify this theorem for the function $f(x) = x^3 - 3x^2 + 2x$ on $(0, 2)$. 12.5

Q3. (a) State and prove Lagrange's Mean value theorem (MVT). 12.5

(b) Verify this theorem for $f(x) = x + \frac{1}{x}$ on the interval $[3, 4]$. 12.5

Q4. (a) Let $f(x) = x^3 - 2x^2 + 2$ 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

SECTION B

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

Q5. (a) State Taylor's theorem with remainder. Use Taylor's theorem to expand $f(x) = \ln x$ in powers of x with the remainder term. 12.5

(b) State and prove L'Hopital's rule. Apply this rule to evaluate $\lim_{x\to 0}\frac{\tan x - \sin x}{x^3}$. 12.5

Q6. Integrate the following 25

(i) $\int \frac{3x}{\sqrt{4x^2+5}}dx$, (ii) $\int \frac{dx}{\sqrt{(x-1)(2-x)}}$, (iii) $\int \cos^3(2t)\sin(2t)dt$, (iv) $\int \frac{dx}{2x^2+x+1}$,

(v) $\int \cos 4\theta \sqrt{2-\sin 4\theta}\, d\theta$.

Q7. (a) State and prove the fundamental theorem of calculus. 6

(b) Evaluate (i) $\int_0^{\frac{\pi}{2}} \frac{dx}{3+2\cos x}$ (ii) $\int_0^1 \frac{dx}{5+x^2}$ (iii) $\int_{-\pi/3}^{\pi/3} \sin x\, dx$. 12

(c) Find the area of the region enclosed by the curves $y^2 = 4ax$ and $x^2 = 4ay$. 7

Q8. (a) Find the area of the region bounded by $x = y^2$ *and* $y = x - 2$. 9

(b) Find the area of the region inside the cardioid $r = 4(1+\cos\theta)$ and outside the circle $r = 6$. 8

(c) Find the arc length of $y = \ln\left(\frac{e^x - 1}{e^x + 1}\right)$. 8

UNIVERSITY OF ASIA PACIFIC
Department of Basic Sciences and Humanities
Final Examination, Fall-2011
Program: B.Sc. Engineering (Civil)

Course Title: Mathematics -II **Course Code: MTH-103**
Time: 3.00 Hrs. **Credit: 3.0** **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) Find the shortest distance between two given lines whose direction cosines are l_1, m_1, n_1 and l_2, m_2, n_2. 15

(b) Find the equation of a plane through the points *(2, -1, 0), (3, -4, 5)* and parallel to the line $2x = 3y = 4z$. 10

2. (a) Find the angle between the lines $3x + 2y + z - 5 = 0 = x + y - 2y - 3$ and $8x - 4y - 4z = 0 = 7x + 10y - 8z$ 12

(b) Find the equation of the straight line through the origin in the plane $x - 2y - 2z - 6$ and perpendicular to the line $\frac{x}{3}=\frac{y}{-2}=\frac{z}{6}$. 13

3. (a) Prove that the section of a sphere by a plane is a circle and to find its radius and circle. 15

(b) Find the equation of the sphere on the join of *(2, -3, 1)* and *(1, -2, -1)* as diameter 10

4. (a) 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. 15

(b) Obtain the equation of the circle lying on the sphere $x^2 + y^2 + z^2 - 2x + 4y - 6z + 3 = 0$ and having its center at *(2, 3, -4)*. 10

SECTION B

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

5. **(a)** Discuss the geometrical interpretation o the cross product of two vectors. 10

(b) Using vector concept prove that in any triangle 15

$$\frac{SinA}{a}=\frac{SinB}{b}=\frac{SinC}{c}$$

6. **(a)** Prove that, vector triple product $\vec{a}\times(\vec{b}\times\vec{c})=(\vec{a}.\vec{c})\vec{b}-(\vec{a}.\vec{b})\vec{c}$ 15

(b) Find the scalar λ so that the vectors $2\mathbf{i}-\mathbf{j}+\mathbf{k}$, $\mathbf{i}+2\mathbf{j}-3\mathbf{k}$, $4\mathbf{i}-\mathbf{j}+\lambda\mathbf{k}$ are coplanar. 10

7. **(a)** Discuss the differentiation of scalar triple product. 10

(b) Define point function, scalar point function and vector point function. 6

(c) Find the directional derivative of $\varphi = 4x^2y - 3x^2z^2 + yz$ at (2, -1, 2) in the direction $-2\mathbf{i}-3\mathbf{j}+5\mathbf{k}$ 9

8. **(a)** Prove that $curl(\varphi\vec{r}) = grad\varphi\times\vec{r}+\varphi\, curl\,\vec{r}$ 6

(b) Prove that $curl\ grad\ \varphi=0$ 6

(c) Find the angle between the surfaces: $xy^2z - 3x + z^2 = 9$ and $3x^2 - y^2 + 2z = 1$ at (1, -2, 1) 13

UNIVERSITY OF ASIA PACIFIC
Department of Basic Sciences and Humanities
Final Examination, Fall-2011
Program: B.Sc. Engineering (Civil)

Course Title: Math III **Course Code: MTH-201** **Credit: 3.0**
Time: 3 (Three) Hours **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 linear combination. Determine whether or not the vector $(1, 2, 6)$ is a linear combination of the vectors $(2, 1, 0)$, $(1, -1, 2)$ and $(0, 3, -4)$. 12

(b) Define linear dependence and independence of vectors. Determine whether the vectors $(1, -2, 1)$, $(0, -1, 0)$ and $(2, 0, 2)$ in ∇^3 are linearly dependent or independent. 13

2. (a) Define basis and dimension. Find the rank of the matrix A where 12

$$A = \begin{pmatrix} 1 & 3 & 1 & -2 & -3 \\ 1 & 4 & 3 & -1 & -4 \\ 2 & 3 & -4 & -7 & -3 \\ 3 & 8 & 1 & -7 & -8 \end{pmatrix}.$$

(b) Let V and W be the following subspaces of ∇^4. 13

$$V = \{(a, b, c, d) : b - 2c + d = 0\}$$
$$W = \{(a, b, c, d) : a = d, \quad b = 2c\}$$

Find a basis and the dimension of (i) V (ii) W and (iii) $V \cap W$.

3. (a) Define linear transformation. Define the kernel and the image of a linear transformation. Let $T : \nabla^2 \to \nabla^3$ defined by $T(x, y) = (x - y, y - x, 4x - 4y)$. Find a basis and the dimension of the kernel of T and the image of T. 15

(b) Determine whether or not the following form a basis for the vector space ∇^3:
(i) $(1, 1, 1)$, $(1, 2, 3)$ and $(2, -1, 1)$. (ii) $(1, 1, 2)$, $(1, 2, 5)$ and $(5, 3, 4)$. 10

4. (a) Let S and T be the linear operators of ∇^2 into ∇^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

(b) Define eigenvalues and eigenvectors. Determine the eigenvalues of the matrix 15

$$A = \begin{pmatrix} 1 & 1 & 2 \\ 0 & 2 & 2 \\ -1 & 1 & 3 \end{pmatrix}.$$

SECTION B

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

5. (a) Define statistics. Describe the scope of statistics. **10**

(b) Given a frequency distribution table in the following: **15**

Class interval	Frequency
71-76	5
76-81	7
81-86	13
86-91	11
91-96	7
96-101	5
101-106	2

Find (i) Arithmetic Mean (ii) Median (iii) Quartile Q_3.

6. (a) What do you mean by probability? A husband and wife appear in an interview for two vacancies in the same post. The probability of husband's selection is $\frac{1}{7}$ and that of wife's selection is $\frac{1}{5}$. What is the probability that (i) both of them will be selected (ii) Only one of them will be selected, and (iii) None of them will be selected? **12**

(b) Out of 1800 students of UAP, 350 played cricket, 410 played football, and 402 played table tennis; of the total 80 played both cricket and football, 132 played football and table tennis, 94 played cricket and table tennis, and 50 played all the three games. (i) How many students played the games? (ii) How many students did not play any games? **13**

7. (a) What do you know about binomial distribution and Poisson distribution? **10**

(b) The overall percentage of failures in a certain examination is 20. If six candidates appear in the examination, what is the probability that at least five pass the examination? **15**

8. (a) The probability that a contractor will get a plumbing contract is $\frac{2}{3}$ and the probability that he will not get an electric contract is $\frac{4}{9}$. If the probability of getting at least one contract is $\frac{3}{5}$, what is the probability that he will get both? **10**

(b) An incomplete distribution is given below:

Variable	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	12	30	?	65	?	25	18

If the total frequency is 229 and median value is 46 then using the median formula, fill up the missing frequencies and calculate the mean of the completed table. **15**

The End

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination Fall 2011
Program : B.Sc Engineering (Civil)

Course Title: Mathematics IV | Credit Hour: 3.00 | Course Code: MTH 203
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. Determine the following Laplace inverse transform

(a) $L^{-1}\{\frac{6s-4}{s^2-4s+20}\}$. 5

(b) $L^{-1}\{\frac{1}{(s-4)^5}+\frac{5}{(s-2)^2+25}+\frac{s+3}{(s+3)^2+36}\}$. 5

(c) $L^{-1}\{\frac{s^2+2s+3}{(s^2+2s+2)(s^2+2s+5)}\}$. 15

2. (a) State the second shifting property of Laplace inverse transform. Find $L^{-1}\{F(s)\}$.

Where $F(s)=\frac{e^{-4s}-e^{-7s}}{s^2}$. 15

(b) Define Convolution. Solve $L^{-1}\{\frac{1}{s(s^2+4s+13)}\}$ using the convolution. 10

3. Use Laplace transform to solve the following initial value problems 25

(i)

$$\frac{d^2y}{dt^2}+y=e^{-2t}\sin t,$$
$$y(0)=0,$$
$$y'(0)=0.$$

(ii)

$$\frac{d^2y}{dt^2}-3\frac{dy}{dt}+2y=4e^{2t},$$
$$y(0)=-3,$$
$$y'(0)=5.$$

4. (a) Define Fourier series. Determine the coefficients a_0, a_n and b_n of Fourier series. 15

(b) Derive the Fourier sine series in the interval $(0, \pi)$. 10

SECTION B

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

5. (a) Derive the Fourier series of complex form in the interval. 10

(b) Obtain the complex form of Fourier series of the following function

$$f(x) = \begin{cases} 0, & -\pi \le x \le 0 \\ 1, & 0 \le x \le \pi \end{cases}$$ 15

6. (a) Derive the Fourier integral for odd and even function on $[0, \infty]$. 15

(b) Find the Fourier integral of the function $f(x) = e^{-kx}$ when $x > 0$ and $f(-x) = f(x)$ for $k > 0$ and hence prove that $\int_0^\infty \frac{\cos ux}{k^2 + u^2} du = \frac{\pi}{2k} e^{-kx}$. 10

7. (a) Define Fourier sine and cosine transform for infinite interval. 4

(b) Find the Fourier sine transform of the following function

$$f(x) = \begin{cases} x^2 & for\ 0 \le x \le 1 \\ 1 - x & for\ 1 < x \le 2 \\ 0 & for\ x > 2 \end{cases}$$ 16

(c) Evaluate the cosine transform of $2e^{-5x} + 5e^{-2x}$. 5

8. (a) Find the Fourier transform of $f(x)$ define by $f(x) = \begin{cases} \frac{1}{2a}, & |x| < a \\ 0, & |x| > a \end{cases}$. 10

(b) Determine the Fourier cosine transform of e^{-x^2}. 15

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination Fall -2011
Program: B.Sc Engineering (CE)

Course Title: Physics I | Course Code: PHY -101 | Credit: 3.00
Time: 3.00 Hours | Full Mark: 150

*[N.B- The figures in the right 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 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

2. (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

3. (a) Show that the moment of inertia of a uniform rod is $\frac{ML^2}{12}$, 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

4. (a) Show that the moment of inertia of a uniform circular disc is $I=\frac{MR^2}{2}$, 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

[Turn over

SECTION B

There are **FOUR** questions. Answer any **THREE**

Marks

5. (a) Show that the total energy of the simple harmonic oscillator is given by $E = \frac{1}{2}kA^2$, where the symbols have their usual meaning. 15

(b) Show that for a particle executing simple harmonic motion, its acceleration at any instant is $a = -\omega^2 y$, where the symbols have their usual meanings. 10

6. (a) Derive the differential equation of a progressive wave; $\frac{d^2y}{dt^2} = v^2\frac{d^2y}{dx^2}$, where the symbols have their usual meanings. 15

(b) A particle executes simple harmonic motion given by the equation $y = 12\sin\left(\frac{2\pi t}{10} + \frac{\pi}{4}\right)$, calculate (i) amplitude, (ii) frequency, (iii) epoch, (iv) acceleration at t = 5 s. 10

7. (a) Prove the equation of Laplace's correction to Newton's formula; $V = \sqrt{\frac{\gamma P}{\rho}}$, where the symbols have their usual meanings. 15

(b) Discuss the effect of temperature on the velocity of sound in gas. 10

8. (a) Derive the equation of Doppler effect when the source at rest and observer 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

University of Asia Pacific
Department of Civil Engineering
Final Semester Examination Fall 2011
Program: Masters in Civil Engineering(MCE)

Course Title: Advanced Design of Concrete Structures Course Code:CE6108
Time:3 Hours Full Marks:100

1.(a).If the depth of beam exceeds 3 ft, the ACI code requires extre steel to be placed along the side of the beam. What is the purpose of this steel? (4)

(b). A reinforced concrete beam can fail in three possible ways. Describe each failure mode briefly. (4)

(c) What is the purpose of the ACI provision requiring a minimum area of flexural steel? (4)

(d) What do you mean "Balanced Steel Ratio"?. Explain the upper limit and lower limit as per ACI code provision. (4)

(e) What is the primary function of ties in RC Column? (4)

(f) What is the PΔ effect? What is the difference between Long and Short Column? (4)

(g) What is the difference between braced and an unbraced frame? (4)

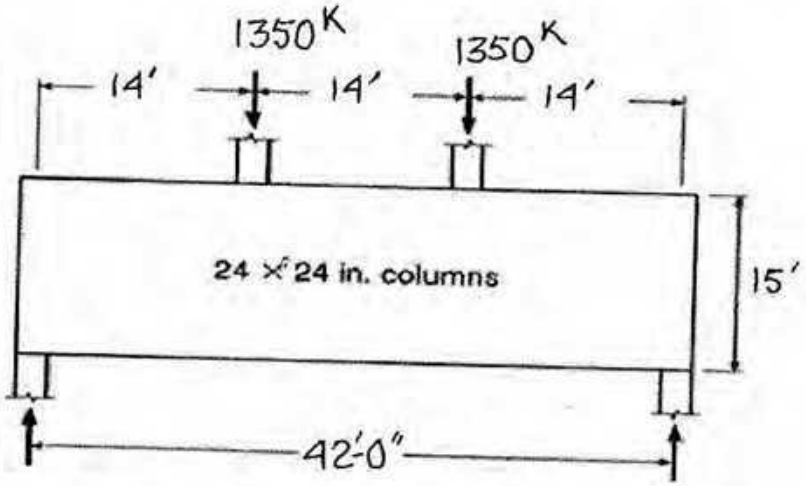
(h) Explain the effective length of column and explain with sketches for following (4)

support conditions-
a. Both end pin support
b. Both end fixed support
c. One end fixed and other end free.
d. Both end fixed but one end can move laterally.

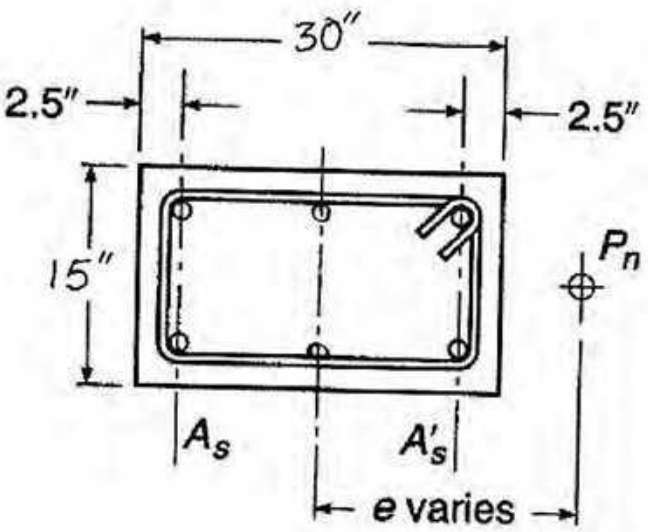
(i). Write the ACI criteria for neglecting slenderness effect of column forBraced versus Non-Braced frame. (4)

(j).Why Strut and tie model is the effective solution in disturbed region of RC member? (4)

2. A transfer girder given in the picture carries a factored load of 3 kips/ft along its top edge. The supporting two columns is to carry 1350 kips. The girder size is 2.5'x15'. Design the beam for the given load. Consider fy=60ksi, fc'=4 ksi. (15)



3.Draw the column strength diagram for the given section and reinforcement- (15)



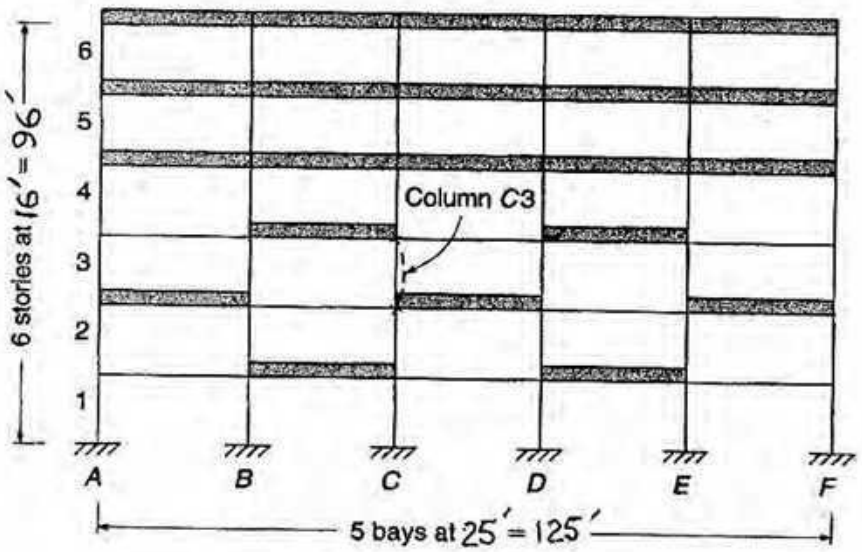
Consider fy=60ksi, fc'=4 ksi.
No of rebar 6
Dia. of Rebar=25mm

4. The following figure is a part of concrete frame building with 54"X12" beams on - (15)

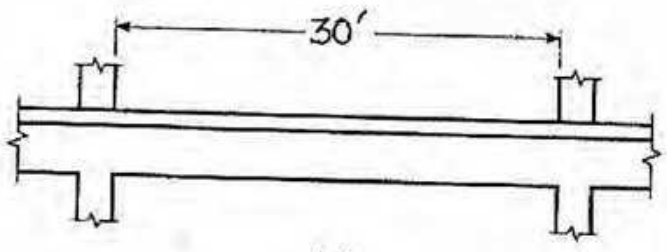
column lines. The clear height of the column is 14ft. All column size are 18"X18". The frame is considered as braced frame. Design the marked column as following service loads---

Dead Load: P=275 kip M_2 =25 kip-ft, M_1=15 kip-ft

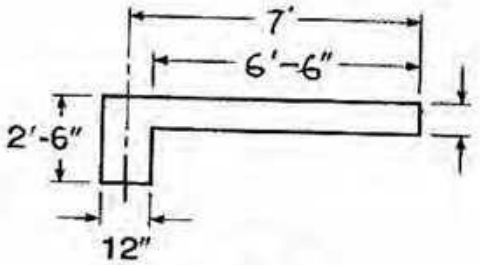
Live Load: P=150 kip M_2 =105 kip-ft, M_1=80 kip-ft



5.The 30 24 ft span beam carries a monolithic slab cantilevering 7 ft past from the beam- (15)
centre line. The slab supporting a live load of 30 psf udl over its upper surface. Design the beam for combined torsion and Shear reinforcement. consider f_c'= 3 ksi f_y=60 ksi



(a)



(b)

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: MCE (Civil)

Course Title: Analysis and Design of Tall Buildings **Course Code: CE 6111**
Time: Two Hours **Full Marks: 100**

Answer any FOUR questions. The figures in the right margin indicate full marks.

1. (a) Define tall building from structural engineer's point of view. (03)

   (b) What do you mean by determination of structural form? What are the factors that affect the choice of structural form? (07)

   (c) Discuss the advantages and disadvantages of the following types of lateral load resisting systems: (15)
   - (i) Coupled shear wall system
   - (ii) Shear wall-frame system
   - (iii) Tubular system

2. (a) Write down the assumptions of continuous medium method for the analysis of coupled shear wall. (05)

   (b) Write down the significance of relative stiffness parameter $\boldsymbol{k\alpha H}$ in the analysis of coupled shear wall structure. (05)

   (c) How does the behavior of shear wall-frame structure under lateral load differ from those of shear walls and frames? Describe with neat sketches. (10)

   (d) What are the advantages of membrane finite element method over the other methods of coupled shear wall analysis? (05)

3. Figure 1 shows the floor plan of a cross wall structure. The shear walls are interconnected through beams (300 mm × 400 mm). The building is 105 m high (30 stories, each of 3.5 m height). The bases of the walls are fixed. A uniform wind load of 1.5 kN/m^2 acts on the building parallel to the short direction. Calculate the stresses due to wind load at the base of each wall in an interior panel. Use the continuous medium method and graphs prepared by Coull and Choudhury. (25)

   Given: $\nu = 0.17$, $\lambda = 1.2$, $E = 36 \times 10^6$ kN/m^2.

   Assume reasonable values of missing data, if any.

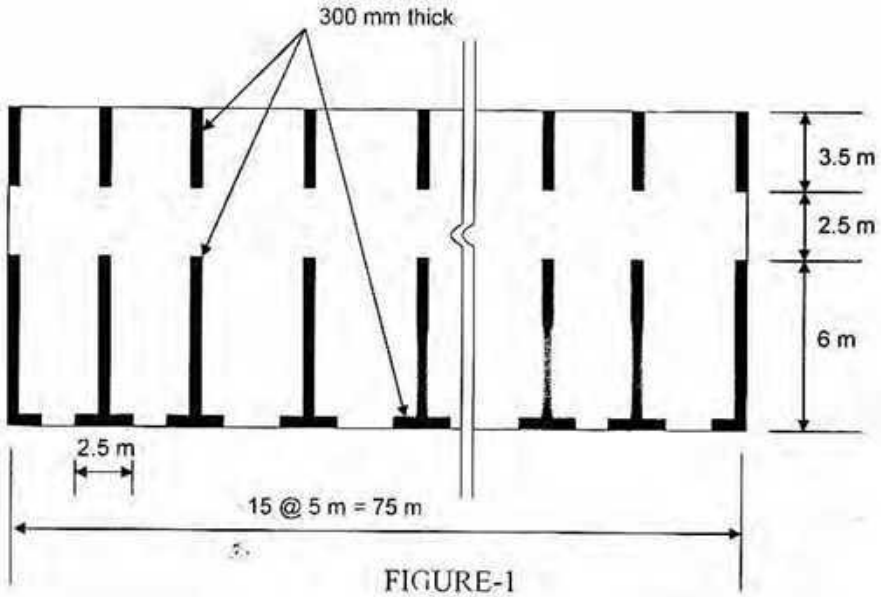


FIGURE-1

4. Figure 2 shows the floor plan of a reinforced concrete shear wall-frame structure. The horizontal resistance to wind acting on its long side is provided by six rigid frame bents and a central core. Calculate the bending moment at the base of the core wall. Neglect the effect of openings in the concrete wall. Use the charts prepared by Heidebrecht and Stafford Smith. The relevant data are given below: (25)

Number of stories: 40
Story height: 3.5 m.
Columns: 600 mm × 600 mm
Beams: 300 mm × 400 mm (for all stories)
Lateral load: 1.5 kN/m^2 UDL.
Wall thickness: 375 mm
E = 2.0×10^7 kN/m^2.

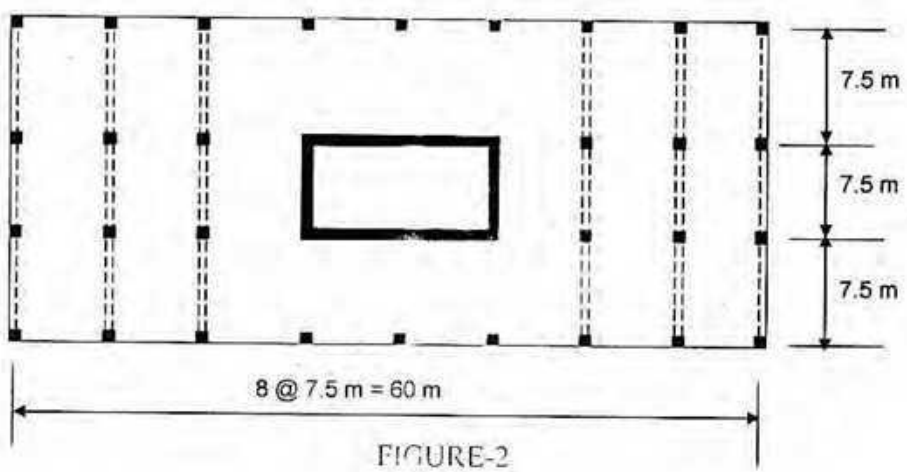


FIGURE-2

5. (a) What do you mean by shear lag? (05)

(b) Figure 3 shows the floor plan of a tube structure. Using Dr. F. R. Khan's method, calculate at Level-1: (20)

(i) Stress in a corner column,
(ii) Stress in column 1 of flange frame,
(iii) Stress in column 1 of web frame, and
(iv) Shear force in the beams connecting the corner columns to column 1 in web frame.

Given:

Lateral load = 40 psf (parallel to short direction)
Number of stories = 50
Columns: 20"×30"
Spandrel Beams: 12"×30"
Story height: 10 ft.

Assume reasonable values of missing data, if any.

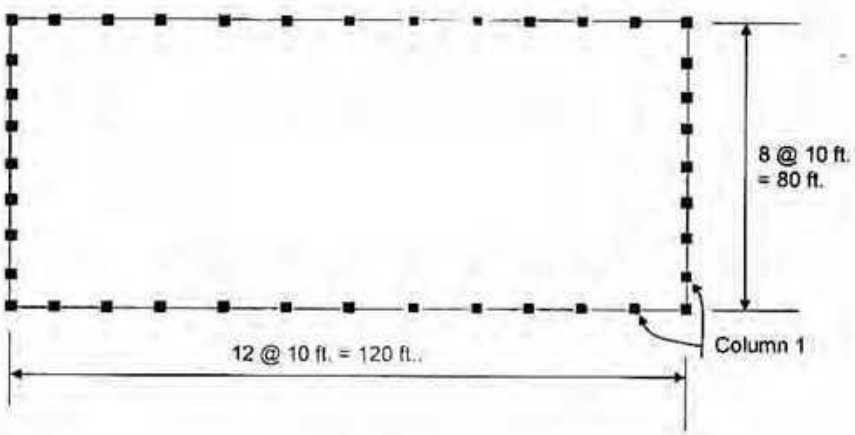


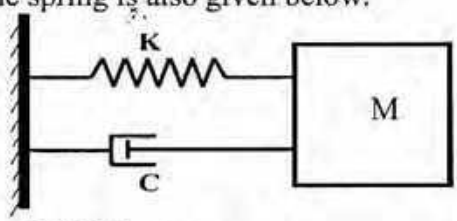
FIGURE-3

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2011
Program: Masters in Civil Engineering (MCE)

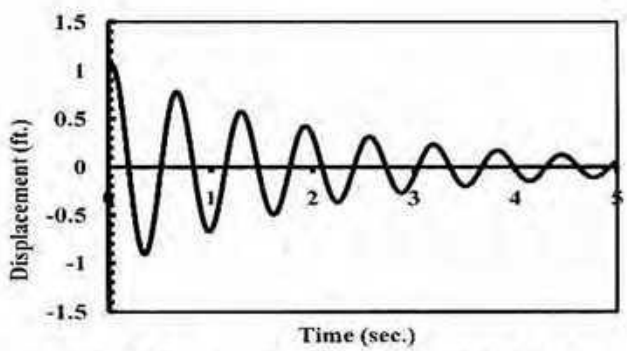
Course Title : Structural Dynamics I — Course Code: CE 6115
Time: Three Hours — Full Marks: 150

Answer ALL questions. The figures in the right margin indicate the marks of the questions.

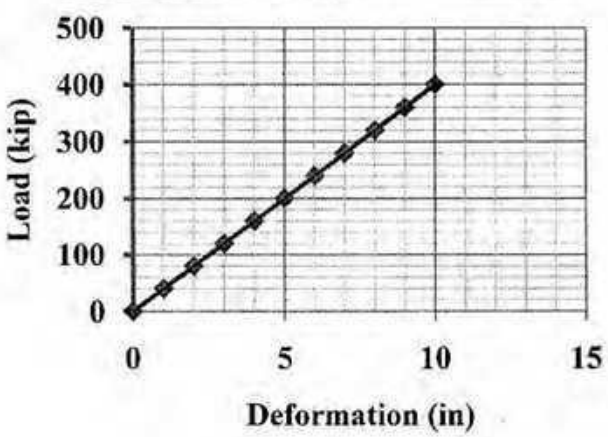
1. Refer to the following SDOF system. Free vibration record of the system is given below. The weight of the mass is 10000 lb. Load deformation curve of the spring is also given below. 30



SDOF System



Free Vibration Record of the SDOF System



Determine the following:

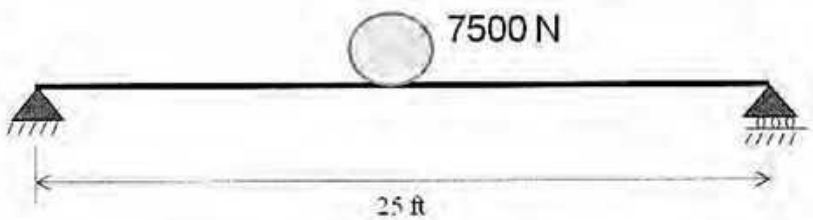
(1) Stiffness,
(2) Undamped natural frequency,
(3) Logarithmic decrement,
(4) Damping ratio,
(5) Critical damping coefficient,
(6) Damping coefficient, and
(7) Damped natural frequency.

2. Refer to the SDOF system of **Question No. 1**. A force of 10000 lb is applied to the system very slowly (without creating any vibration) and then released suddenly. For this system write or determine the following: 30

(1) Equation of motion,
(2) Solution for displacement,
(3) Solution for velocity,
(4) Solution for spring force,
(5) Solution for damping force,
(6) Solution for inertia force,
(7) Displacement after 5 sec,
(8) Velocity after 5 sec,
(9) Spring force after 5 sec,
(10) Damping force after 5 sec, and
(11) Inertia force after 5 sec.

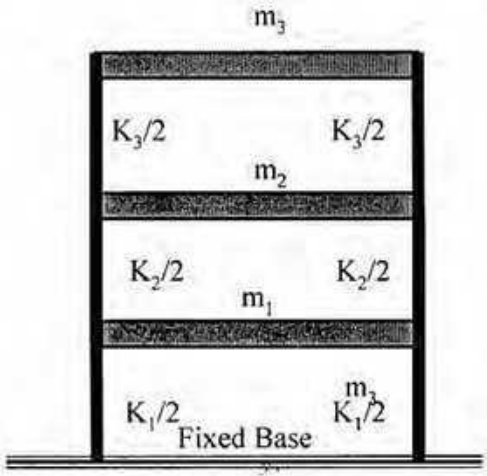
3. Define transmissibility. Draw the curves to explain the variation of transmissibility with the change of damping ratio and frequency ratio. Briefly explain the curves. 10

4 Refer to the following simply supported beam. 10



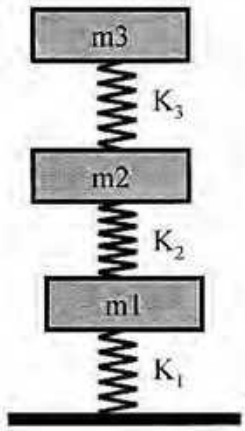
An oscillator of weight 5000 N is placed at the middle of the beam which oscillates at a speed of 600 rpm. The statical displacement of the beam is 0.025 cm at the middle due to the weight of the oscillator. Neglect the weight of the beam. Assume that the damping is equivalent to a force acting at the middle of the beam proportional to the velocity and equal to 500 N at a velocity of 2.5 cm/s. Determine the magnification factor due to the forced vibration produced by the oscillator. The beam can be modeled as a SDOF system.

5. Refer to the following 3-DOF system. 30



Three Storey Building

Very stiff floor slabs relative to the supporting columns.



Model – 3DOF

By modal analysis, determine the modal frequencies and mode shapes of the building.

Given:
$m_1 = m_2 = m_3 = 25$ ton
$K_3 = K = 15{,}000$ kN/m
$K_2 = 1.5\ K$, $K_1 = 2.5\ K$
1 kN = 1 ton.m/sec2

6. Express the following forcing function into Fourier series. Derive the expression for steady state response of a SDOF system subjected to the loading function given below. 40