University of Asia Pacific
Department of Civil Engineering
Final Examination (Spring 2013)
Program: B.Sc. Engg ((3rd year 1st semester)

Course Title: Principles of Accounting **Credit Hours: 2.0** **Course: ACN 301**
Time : 2 hrs **Full marks: 50**

(Answer any four questions taking two questions from each part)

Part-A

Q.1.a. SMEC BD Ltd began business on January 2012. The company provides real estate service to customers. The adjusted trial balance of the company for the year 2012 is as follows: (all figures are in '000BDT)

SMEC BD LTD.
Trial Balance (Adjusted)
December 31, 2012

	Debit	Credit
Cash	14,500	
Accounts Receivable	23,600	
Prepaid Insurance	1,600	
Land	56,000	
Building	106,000	
Equipment	48,000	
Accounts Payable		10,400
Unearned Rent Revenue		1,800
Mortgage Payable (Long term)		100,000
Smec, Capital		120,000
Smec, Drawing	20,000	
Service Revenue		75,600
Rent Revenue		26,200
Salaries Expense	30,000	
Advertising Expense	17,000	
Utilities Expense	15,800	
Insurance Expense	1,500	
Depreciation Expense- Building	2,500	
Accumulated depreciation-Building		2,500
Depreciation Expense- Equipment	3,900	
Accumulated depreciation-Equipment		3,900
Interest Expense	10,000	
Interest Payable		10,000
Total	**350,400**	**350,400**

Instructions:
Prepare a classified balance sheet at December 31, 2012. *(Balance of Owner's equity statement at December 31 is 121,100. No need to prepare Income Statement or Owner's Equity Statement.)* **(9.0)**

Q.1.b. Explain with example why a prepaid expense is classified as an asset on a balance sheet. **(3.5)**

Q.2. Financial information for Walnut Company is presented below.

WALNUT COMPANY
Balance Sheets
December 31, 2012

	2012	2011
Assets		
Current assets		
Cash and cash equivalents	70,000	65,000
Short-term Investment	45,000	40,000
Accounts receivable (net)	94,000	90,000
Inventories	130,000	125,000
Prepaid expenses and other current assets	25,000	23,000
Total current assets	**364,000**	**343,000**
Property, plant, and equipment (net)		
Land	130,000	130,000
Building and Equipment	200,000	175,000
Total assets	**$694,000**	**$648,000**
Liabilities and Stockholders' equity		
Current liabilities	185,000	182,000
Long-term liabilities	150,000	150,000
Stockholders' equity – common stock	200,000	200,000
Retained Earnings	159,000	116,000
Total liabilities and stockholders' equity	**$694,000**	**$648,000**

WALNUT COMPANY
Income Statement
For the Years Ended December 31 2012

	2012	2011
Sales	850,000	790,000
Less: Cost of goods sold	620,000	575,000
Gross profit	230,000	215,000
Less: Operating expenses	194,000	180,000
Net income	$ 36,000	$ 35,000

Additional information:

- Inventory at the beginning of 2011 was BDT115,000.
- Receivables (net) at the beginning of 2011 were BDT88,000.
- Total assets at the beginning of 2011 were BDT610,000.

Compute the following ratios for 2012 and 2011 and make comments.

a. Current Ratio
b. Asset turnover
c. Profit margin ratio.
d. Debt to total assets ratio. **(4X2.5=10+2.5)**

Q.3. a) John Devon opened a consultancy firm on March 1. During March the following transactions were completed:

Mar 1: Invested BDT 2,50,000 cash in business.
Mar 1: Purchased equipment for BDT 60,000, paying BDT 40,000 cash and balance on account.
Mar 2: Purchased supplies for BDT 8,000 cash.
Mar 3: Paid BDT 12,000 cash on **one year prepaid insurance policy** effective March 1.

Mar 5: Billed customers BDT 480,000 for consultancy service provided.
Mar 18: Paid BDT 15,000 cash on account payable for equipment purchase. (March1)
Mar 28: Paid BDT 12,000 cash for employee salaries.
Mar 28: Received cash from customer billed on Mar 5.
Mar 31: Withdrew BDT 7000 cash for personal use.

Adjustment data consist of:

1. Salary accrued but not paid BDT 5000.
2. Depreciation of equipment for the month is BDT 1000.
3. Prepaid insurance expired for 1 month.

Instructions:

a. Journalize March transaction.
b. Prepare adjusting journal. (2+3+.5)

Part-B

Q.4. Joyeeta Habib is the advertising manager for Crown Cement Ltd. She is currently working on a major promotional campaign. Her ideas include the installation of a new lighting system and increased display space that will add $51,000 in fixed costs to the $204,000 currently spent. In addition, Joyeeta is proposing that a 6.67% price decrease (from $30 to $28) will produce an increase in sales volume from 16,000 to 21,000 units. Variable costs will remain at $13 per pair of shoes. Management is impressed with Joyeeta's ideas but concerned about the effects that the changes will have on the break-even point and the margin of safety.

Instructions

a. Compute the current break-even point in units, and compare it to the break-even point in units if Joyeeta's ideas are used.
b. Compute the margin of safety ratio for current operations and after Joyeeta's changes are introduced.
c. Forget about Joyeeta's proposal. In current scenario if the company has a target net income of $221,000 for the following year, what should be the required sales in dollars for the company to meet its target? **(5+5+2.5)**

Q.5. San Antonio Inc. manufactures basketballs for the National Basketball Association (NBA). For the first 6 months of 2011, the company reported the following operating results while operating at 90% of plant capacity.

	Amount	**Per Unit**
Sales (90,000units)	$4,500,000	$50
Cost of Goods Sold	$3,600,000	$40
Gross Profit	$ 900,000	
Operating Expense	$ 360,000	
Net Profit	$ 540,000	

Fixed costs for the period were: Cost of goods sold $ 900,000 and selling and administrative expenses $225,000. In July, normally a slack manufacturing month, San Antonio receives a special order for 6,000 basketballs at $35 each from the Italian Basketball Association (IBA). Acceptance of the order would increase variable selling and administrative expenses $0.50 per unit because of shipping costs but would not increase fixed costs and expenses.

Instructions:

a. Prepare an incremental analysis for the special order.
b. Should San Antonio Inc. accept the special order? **(10+2.5)**

Q.6. GPH Ispat Ltd. specializes in manufacturing steel. The product is well accepted by consumers, and the company has a large number of orders to keep the factory production at 10,000 ton per month. GPH's monthly manufacturing cost and other expense data are as follows:

Factory manager's salary	BDT 50,000
Maintenance costs on factory building	3000
Advertising for motorcycles	100,000
Sales commissions	50,000
Depreciation on factory building	7000
Rent on factory equipment	50,000
Insurance on factory building	30,000
Raw materials	200,000
Utility costs for factory	8000
Supplies for general office	2000
Wages for assembly line workers	320,000
Depreciation on office equipment	5000
Miscellaneous materials (lubricants, solders, etc.)	7000

Instructions

(a) Prepare an answer sheet with the following column headings:

	Product Costs					
Cost Item	Direct Materials	Direct Labor	Manufacturing Overhead	Period Costs	Prime Costs	Conversion Costs

Enter each cost item on your answer sheet, placing the dollar amount under the appropriate headings. Total the dollar amounts in each of the columns.

(b) Compute the cost to produce one ton of steel. (use all amount classified under product cost)

(10+2.5)

I-I

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

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

There are fourteen (14) questions. Answer any ten (10)

1. In the fig:1 below, calculate the resultant (magnitude and direction) of the following coplanar concurrent force system.

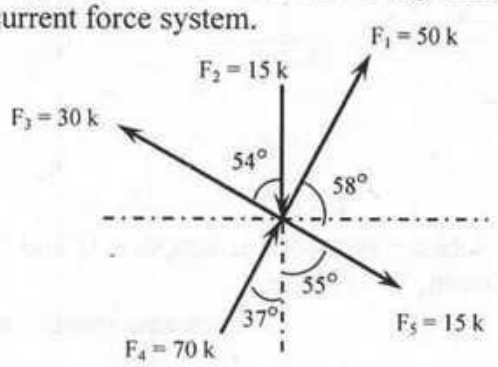


Fig :1

2. In the fig :2 below, a chord supported at A and B carries a load of 20 kN at D and a load W at C. Find the value of W so that CD remains horizontal.

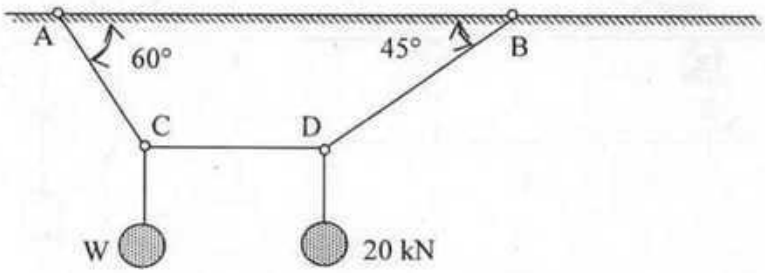


Fig :2

3. Three spheres 1, 2 and 3 are at equilibrium as shown in Fig. 3 below. $W_1 = 60$lb, $W_2 = 150$ lb and $W_3 = 30$ lb. Find the reaction at F

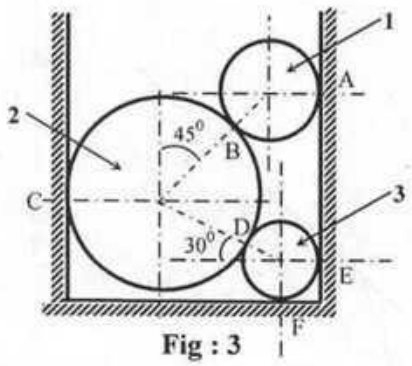


Fig : 3

4. In the fig: 4 below determine support reactions at A & B and all other internal pins. Identify two-force members and determine the forces in those members. Assume all the members of the framework are weightless.

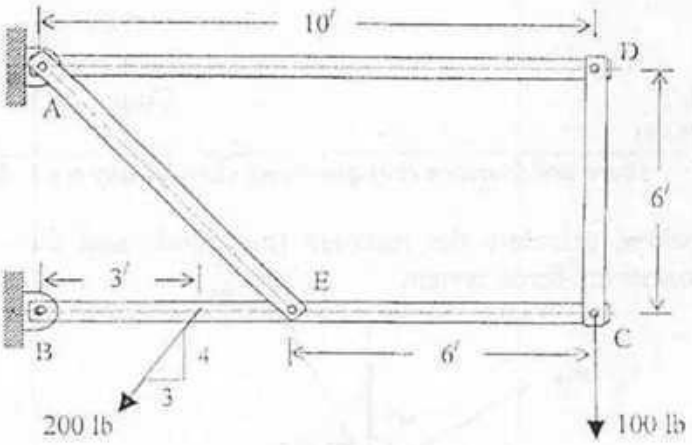


Fig :4

5. In the fig: 5 shown below calculate the reactions at supports B and D and the shear force and bending moment at C. Given, W=300 kip.

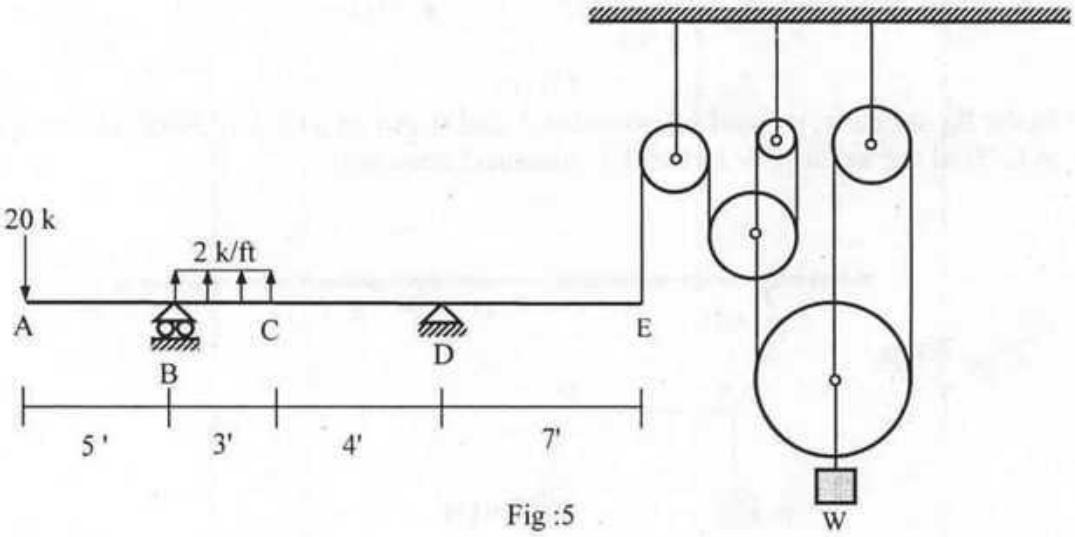


Fig :5

6. In the fig: 6 below, find the co-ordinates of the centroid of the area bounded by $y = ax$ and $y = bx^2$.

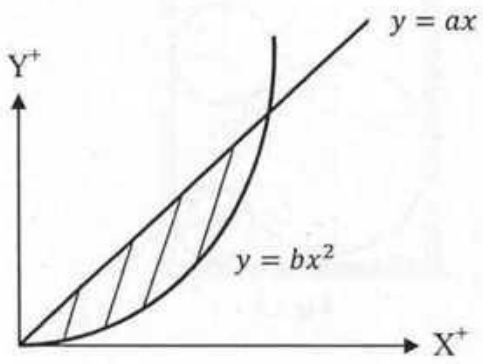


Fig :6

7. Determine the centroid of the shaded area shown in Fig.7.

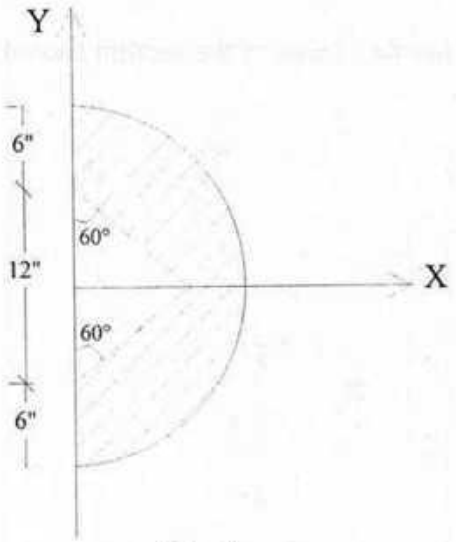


Fig. 7

8. Compute I_x and I_y for the shaded area shown in the fig: 8 below.

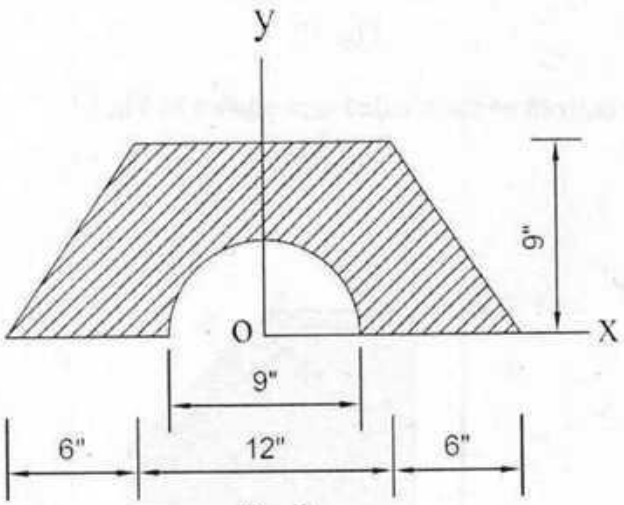


Fig. 8

9. In designing a beam, the moment of inertia of a section of the beam about a centroidal axis is needed. Find the moment of inertia of the T-section shown in fig 9 about a centroidal axis parallel to MN.

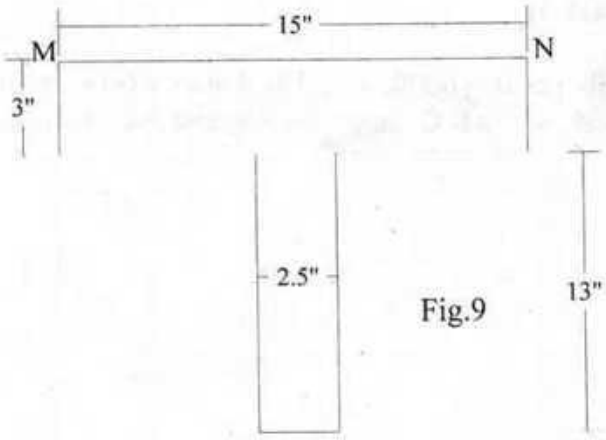


Fig.9

10. Find the centroidal moment of inertia of area of the section shown in Fig.10.

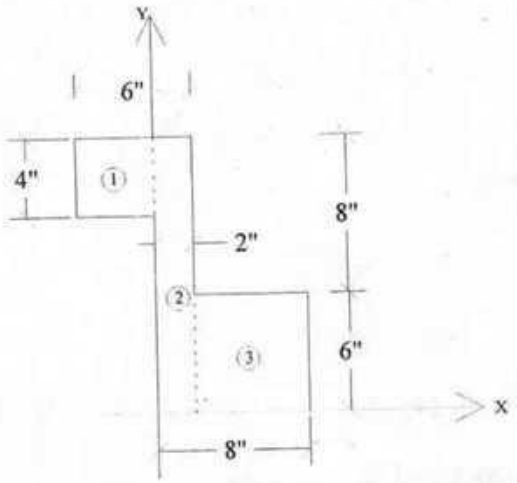


Fig. 10

11. Determine the centroid of the shaded area shown in Fig.11.

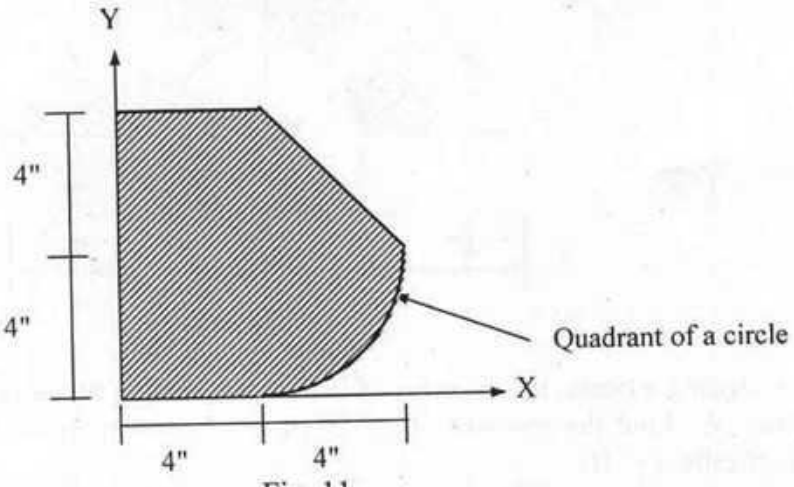


Fig: 11

12. a) Prove that the shape of a flexible chord loaded by uniform loading per unit of horizontal span length is **PARABOLA.**

b) A cable weighing 2 lb. per ft is 600ft. long.The distance between the points of support , which are on a horizontal, is 350 ft.Compute the sag and maximum tension in the cable.

13. For the truss shown in Fig.12, find the forces in the members bl, mc, bc, eq,dp, gf and al.

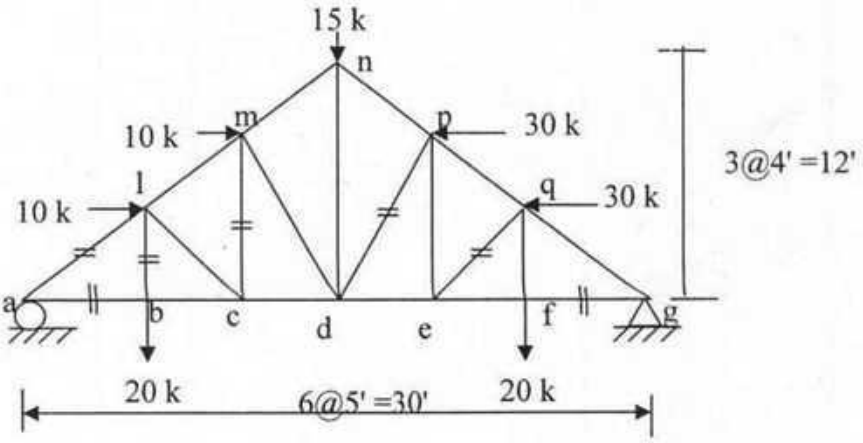


Fig: 12

14. In the fig: 13 shown below, the frictional force F = (0.15)(N). If R is the resultant of W, T, N and F, calculate the magnitudes of N, F and R.

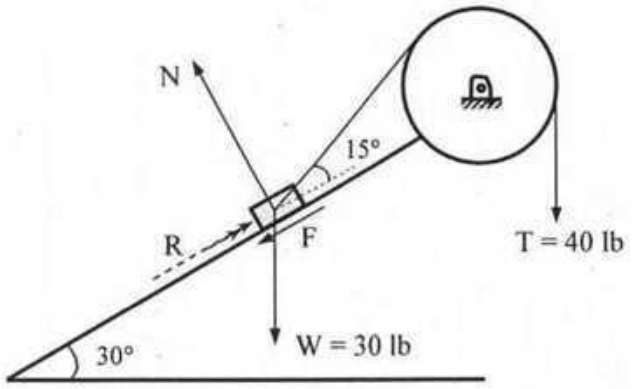


Fig: 13

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc Engineering (Civil)

Course Title: Engineering Mechanics I
Time: 3.00 Hours

Course Code: CE 101
Full Marks: 100 (=10×10)

*There are **fourteen (14)** questions. Answer any **ten (10)**.*
Assume any missing data reasonably.

1. In the figure-1 below, calculate the resultant (magnitude and direction) of the following coplanar concurrent force system.

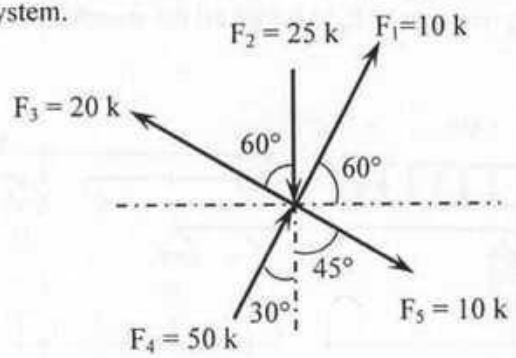


Figure-1

2. In the figure-2 shown below, the frictional force F = (0.15)(N). If R is the resultant of W, T, N and F, calculate the magnitudes of N, F and R.

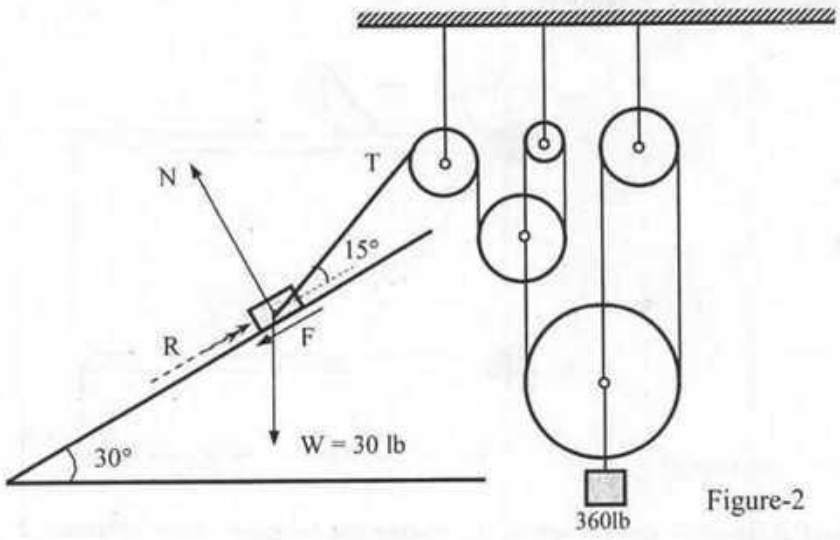


Figure-2

3. Three spheres 1, 2 and 3 are at rest (in equilibrium) against smooth surfaces (frictionless) as shown in the figure-3 below. $W_1 = 60$ lb and $W_2 = 120$ lb and $W_3 = 30$ lb. Find the reactions at A, B, C and D.

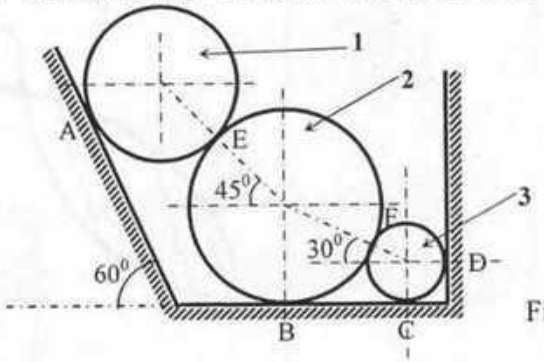


Figure-3

4. In the figure-4 shown below, find W and F_1 so that the cable AB remains horizontal.

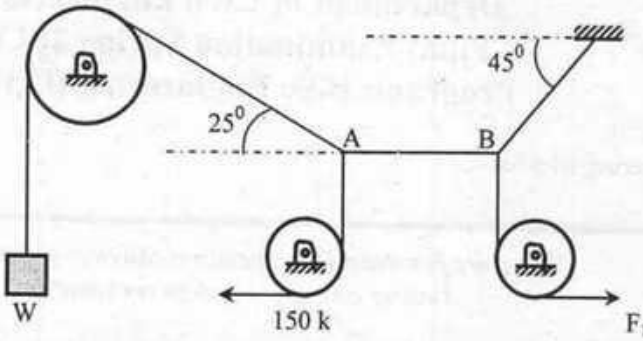


Figure-4

5. In the figure-5 shown below, calculate the reactions at supports A, B and D and also calculate the axial force, shear force and bending moment at E. Assume all the members are weightless.

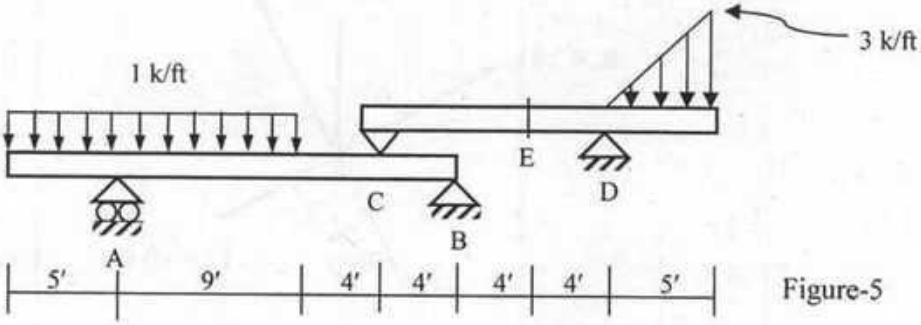


Figure-5

6. In the figure-6 shown below, determine support reactions at A & B and all other internal pins. Identify two-force members and determine the forces in those members. Assume all the members of the framework are weightless.

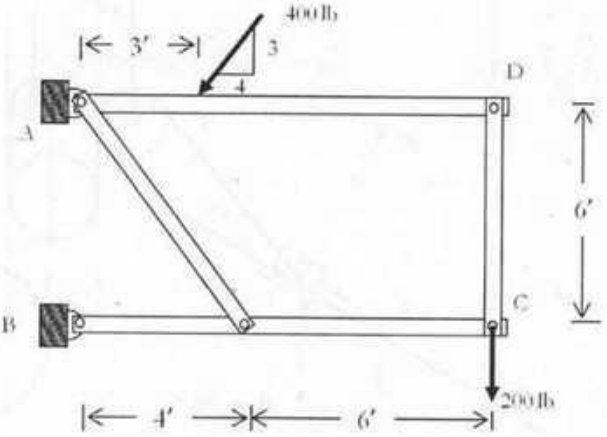


Figure-6

7. In the figure-7 shown below, determine the location of the centroid of the area enclosed by ~~area of~~ the parabola $y^2 = 9x$ and $x^2 = 4y$, where the linear units are in inches.

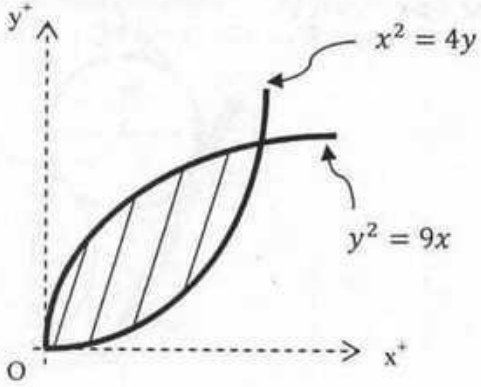


Figure-7

8. In the figure-8 shown below, determine the centroid of the shaded area.

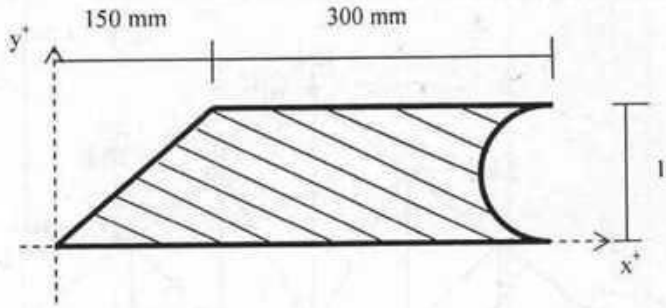


Figure-8

9. a) State the Pappus-Guldinus theorems.
b) Using Pappus-Guldinus theorem, find (i) the surface area and (ii) the volume generated of a cylinder.

10. Compute I_x and I_y for the shaded area shown in the figure-9 below.

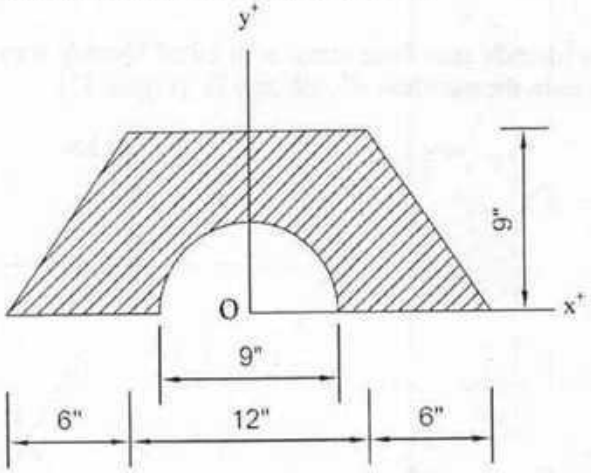
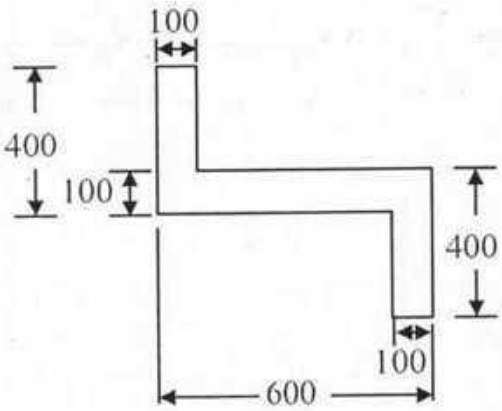


Figure-9

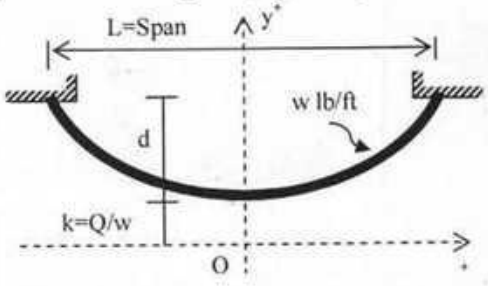
11. In the figure-10 below, determine the moments of inertia of the beam's cross-sectional area about centroidal axes.



Dimension in mm

Figure-10

12. Derive an expression defining the shape of a catenary in cartesian coordinates when the low point of the catenary is a distance $k = Q/w$ above the origin O [figure-11].



Q= Horizontal tension force at the low point of catenary

Figure-11

13. For the truss shown in Figure-12, find the forces in the members bl, mc, bc, eq and fg.

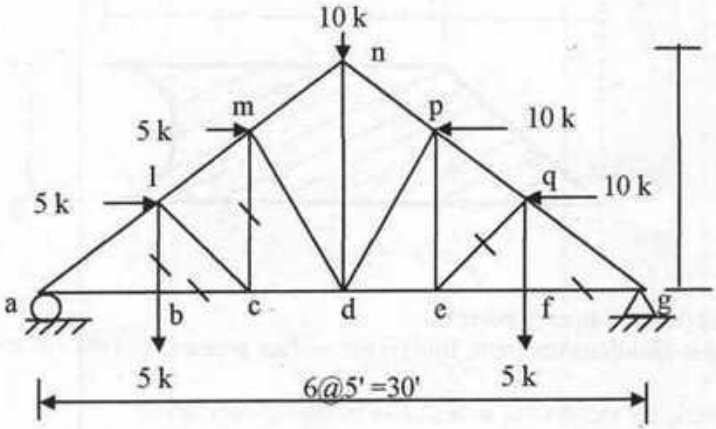
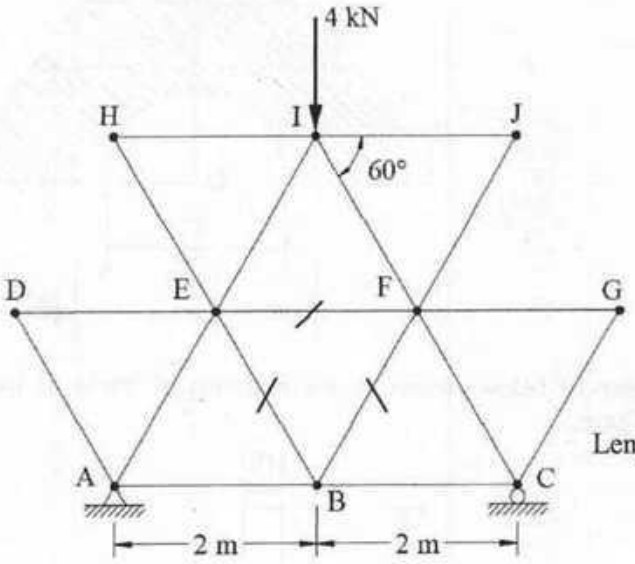


Figure-12

14. How do you identify zero-force member in truss? Identify zero-force member in the following truss and find the forces in the members BF, BE and EF [Figure-13].



Length of each member= 2m

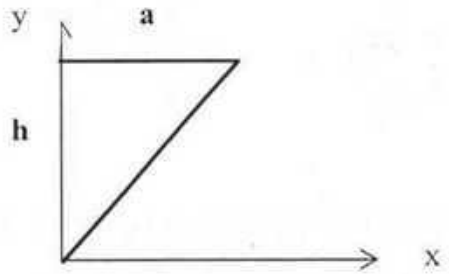
Figure-13

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program : B.Sc Engineering (Civil)

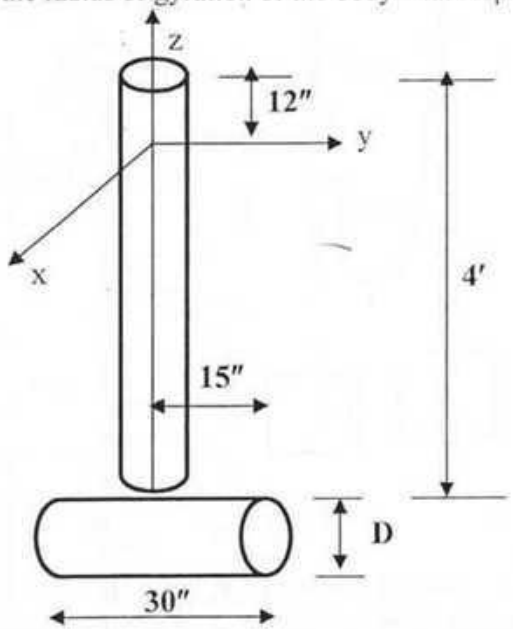
Course No: CE 103 | Course Title: Engineering Mechanics II
Full Marks: 150 | Time: 3.0 hours

There are **EIGHT** questions. Answer any **SIX**. The figures in the right margin indicate the marks of the questions.

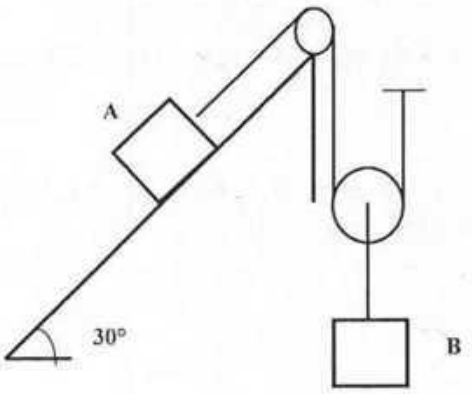
1.(a) Calculate mass moment of inertia of the triangular plate about the y-axis. Assume the plate is made of a uniform material and has a mass of m. (12)



(b) The wood handle of the mallet, shown in the following figure, is L = 4 ft long, 3.69 lb in weight and has a uniform cross section. The head, weighing 15.8 lb, is a wood cylinder of diameter D = 5 inch. The mallet head with the handle inclusion is homogeneous. Find the radius of gyration of the body with respect to the 'x' axis. (13)

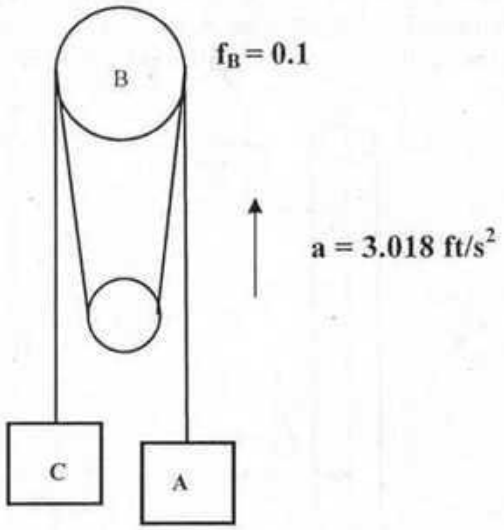


2.(a) In the following figure, the pulleys are weightless and frictionless. The coefficient of friction between the block and incline is 0.25. If the system starts from rest, determine the acceleration of each block. Also find out the tension of each cord. **(13)**

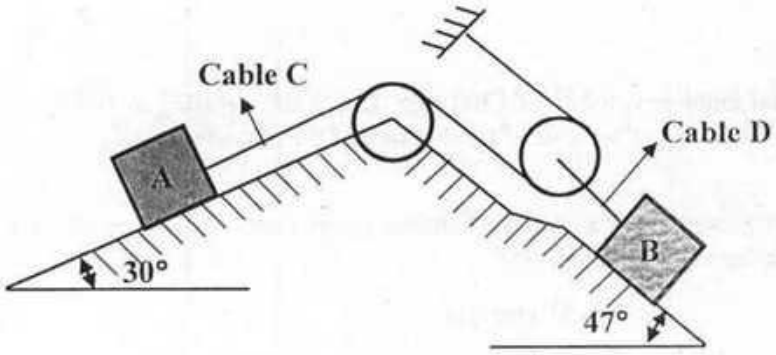


(b) Derive the relation between the tight tension and slack tension, i.e., $T_1 = T_2 e^{f\theta}$. **(12)**

3.(a) Refer to the following figure, weight of block A is 5000 lb. What is the value of weight C? **(10)**



(b) In the following figure, $W_A = 300$ lb, $W_B = 175$ lb, $f_A = 1/4$, $f_B = 1/3$. How far and in what direction does 'A' travel from rest during 25 sec? Find also the forces in the cable **C** and in the cable **D**. The cables are weightless and the pulleys are weightless and frictionless. **(15)**



4.(a) The position of a particle which moves along straight line is defined by the relation, $s = t^3-6t^2-15t+40$, where s is in ft and t is in second. Determine (12)

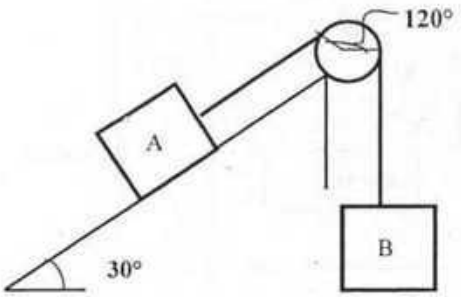
(i) The time at which the velocity will be zero

(ii) The position and distance traveled by the particle at that time

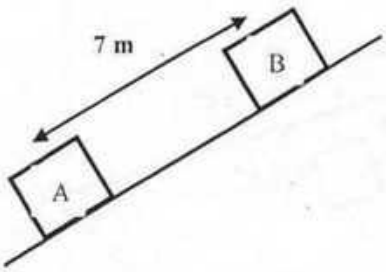
(iii)The acceleration of the particle at that time

(iv) The distance traveled by the particle from 4 sec. to 6 sec.

(b) A 50 lb block is in a plane inclined at an angle of 30°. The coefficient of friction is 0.2 for both plane and cable. As shown in the figure, another block B weighing 100 lb is suspended from the other end of the cable. What are the tension forces in the cable? What is the speed of block A after moving 20 ft from rest? Assume that weight of the cable is negligible. (13)



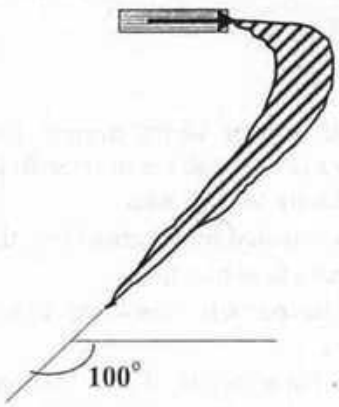
5.(a) Boxes are placed on an incline at uniform intervals of time t and slide down with uniform acceleration. As any box B is released with proceeding box A already had moved 7 m and 1 second. Later A and B are 12 m apart. Determine the value of t. (13)



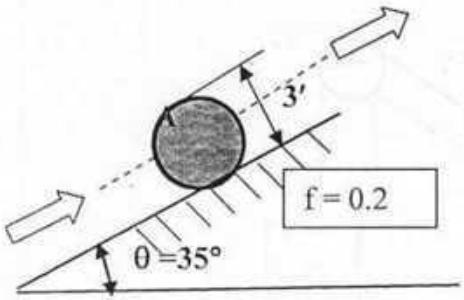
(b) A particle has initial angular velocity of 1200 rpm. If it is decelerating at 100 rpm^2 when it will stop? Find out the number of revolutions of the particle. **(12)**

6.(a) Determine the force exerted by a 75 mm diameter jet of water flowing at 35 m/s on a cup that turns the water through 100°. **(12)**

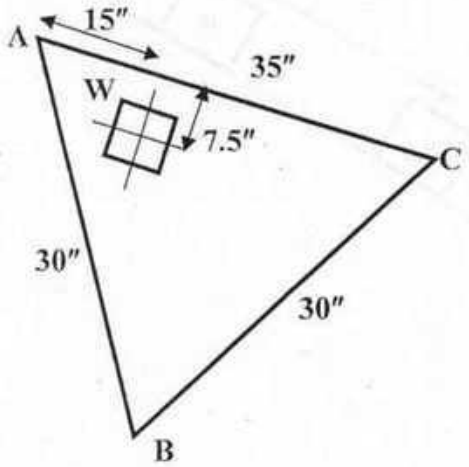
Water jet



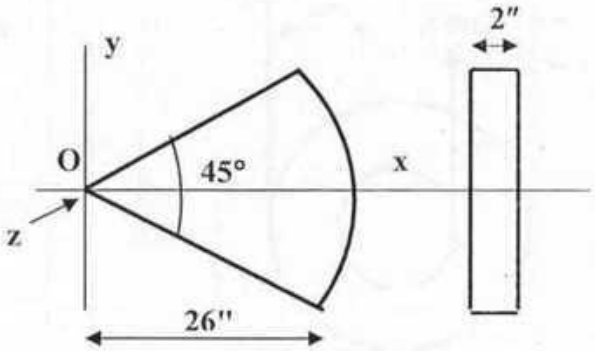
(b) Refer to the following figure, a bullet weighing 0.3 N moving at 600 m/s penetrates 40 N body and emerges with a velocity of 100 m/s. How far and how long will the body move? **(13)**



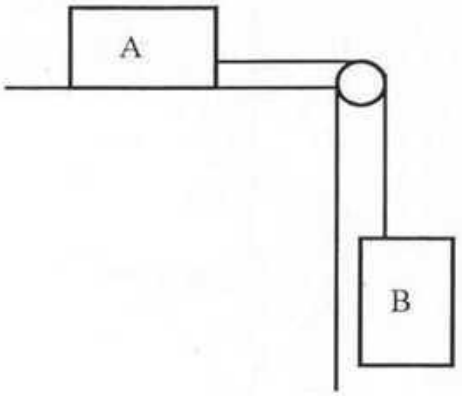
7.(a) As shown in the following figure, the weight W = 95 lb is placed on a triangular table. Find the reactions at supports **A**, **B** and **C**. **(13)**



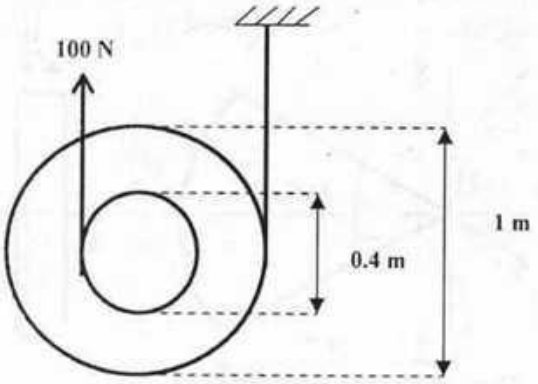
(b) A 45° sector of a cast iron disk with a radius of 26″ is used to balance the reciprocating part of a certain engine as shown in the following figure. Find the mass moment of inertia about the **z** axis. Unit weight of cast iron is 450 lb/cft. (12)



8.(a) Two blocks are joined by an inextensible cable as shown. The system is released from rest. What is the velocity of block A after moving 5 ft? Given that frictional coefficient is 0.25 between block A and the plane and the pulley is weightless and frictionless. Use work – energy principle. (12)



(b) The spool in figure has a mass of 8 kg and a radius of gyration of 0.35 m. If cords of negligible mass are wrapped around its inner hub and outer rim as shown, determine the spool's angular velocity 3 seconds after it is released from rest. **(12)**



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013 (Section B)
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics II
Time: 3 hours

Course Code: CE 103
Full Marks: 100 (= 10 × 10)

Answer **any 10 (TEN)** of the following **14 (FOURTEEN)** questions. The figures in the right margin indicate the marks of the questions. Assume reasonable values for missing data only, if any.

1. Determine the mass moment of inertia about Y-Y axis of the sphere shown in FIGURE 1. **(10)**

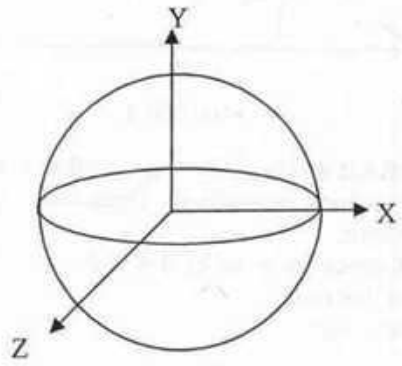


FIGURE 1

2. Determine the mass moment of inertia of the composite body shown in FIGURE 2 about Z-Z axis. It is given that the unit weight of the cone is 490 lb/ft^3 and unit weight of the cylinder 530 lb/ft^3. **(10)**

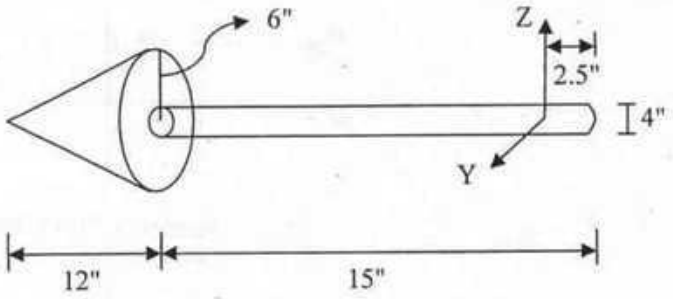


FIGURE 2

3. What is the minimum load W that can be supported by the system shown in FIGURE 3. **(10)**

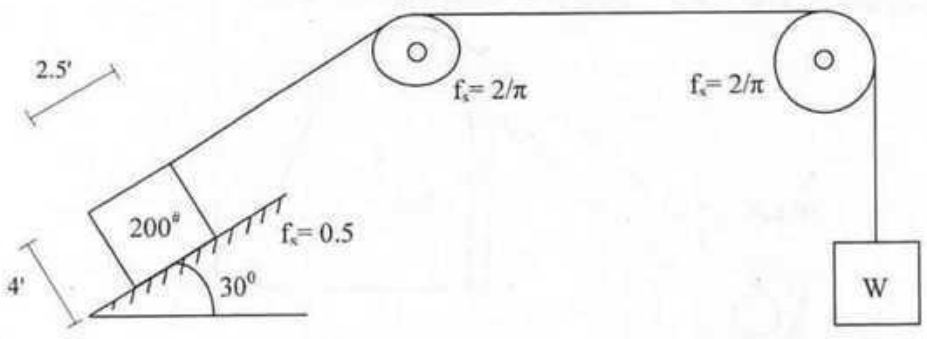


FIGURE 3

4. Referring to FIGURE 4, determine the range of values which the horizontal force P may have without disturbing the equilibrium of the 100-lb block resting on the plane inclined at an angle of 40^0 with the horizontal. The coefficient of friction between the block and the plane is $f_s = 0.25$ **(10)**

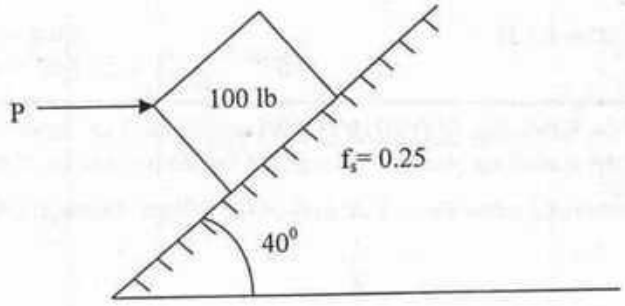


FIGURE 4

5. The motion of a particle is defined by the following equation $x = 6t^4 - 2t^3 - 12t^2 + 3t + 3$, where x and t are expressed in feet and seconds, respectively. Determine **(10)**
   I. Time when velocity is zero.
      (a) Position and distance travelled by that time.
      (b) Acceleration at that time.
   II. Time when acceleration is zero.

6. A motorist starts from rest at Point A, as shown in FIGURE 5, on a circular entrance ramp when t = 0, increases the speed of her automobile at a constant rate and enters the highway at Point B. Knowing that her speed continues to increase at the same rate until it reaches 180 km/h at Point C, determine (a) the speed at Point B, (b) the magnitude of the total acceleration when t = 14 s. **(10)**

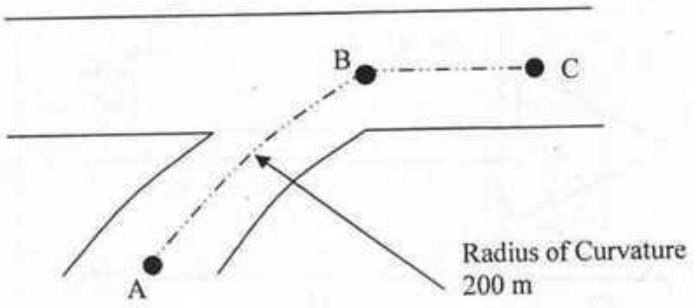


FIGURE 5

7. A 2 kg ball of negligible size is fired from point A with an initial velocity of 10 m/s up the smooth inclined plane, as shown FIGURE 6. Determine the distance from point C to where it hits the horizontal surface D. Also, what is its velocity when it hits the surface. **(10)**

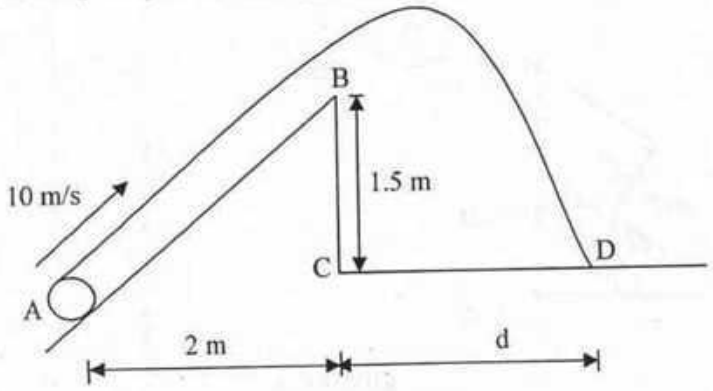


FIGURE 6

8. Referring to FIGURE 7, a 10-lb block passes point A on the smooth track with a speed of $v_a = 5$ ft/s determine the normal reaction of the block when it reaches point B. **(10)**

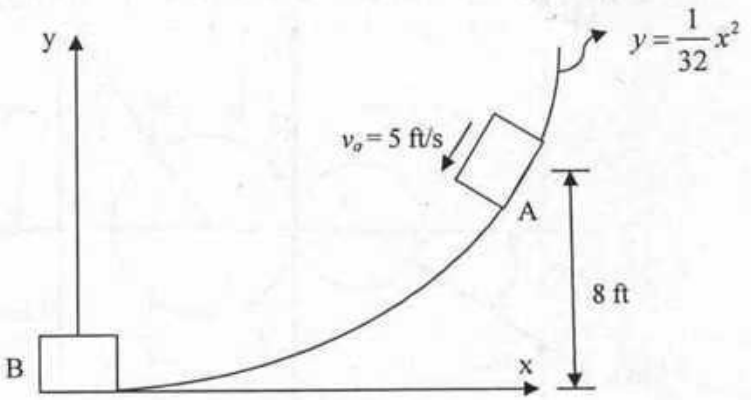


FIGURE 7

9. A 2.5-Mg car increases its speed uniformly from rest to 30 m/s in 30 s up the inclined road, as shown in FIGURE 8. Determine the maximum power that must be provided by the engine, which operates with an efficiency of $\varepsilon = 0.8$. Also find the average power supplied by the engine. **(10)**

FIGURE 8

10. Blocks A and B, as shown in FIGURE 9, have a mass of 4 kg and 6 kg, respectively. If the system is released from the rest, determine the velocity of block B in 7 s. Neglect the mass of pulleys and cord. **(10)**

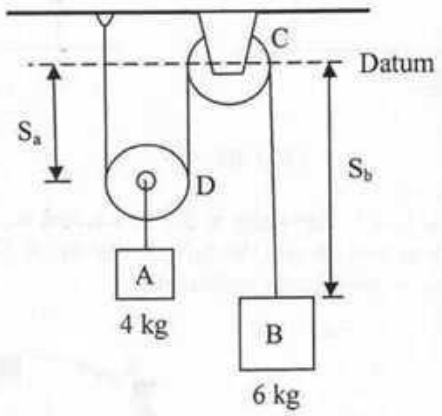


FIGURE 9

11. Two smooth disks A and B, having a mass of 1 kg and 2 kg, respectively, collide with each other with the velocity shown in FIGURE 10. If the coefficient of restitution for the disks is e = 0.75 then, determine the x and y components of the final velocities of each disks just after the collision. **(10)**

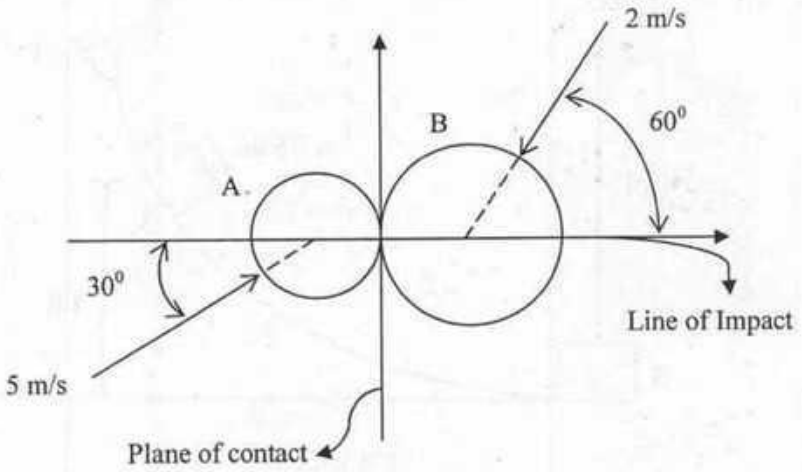


FIGURE 10

12. A 200 g projectile is fired with a velocity of 900 m/s towards the center of 15 kg wooden block, which rests on a rough surface, as shown in FIGURE 11. If the projectile penetrates and emerges from the block with a velocity of 300 m/s, determine the velocity of the block just after the projectile emerges. How long the block will slide on the rough surface, after the projectile emerges from the rough surface, before it comes to rest again? The coefficient of kinetic friction between the block and the surface is 0.2. **(10)**

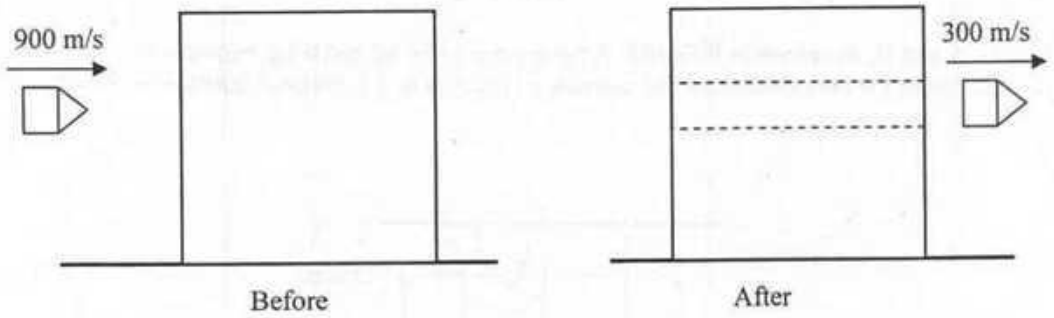


FIGURE 11

13. A 75 kg man can throw a 15 kg box horizontally at 5.2 m/s when standing on the ground. If instead he firmly stands on a 100 kg boat and throws the box, as shown in FIGURE 12, determine how far the boat will move in 3 seconds. Neglect water resistance. **(10)**

FIGURE 12

14. Referring to FIGURE 13, determine the force acting along the axis of each of the three struts needed to support the 500 kg block. **(10)**

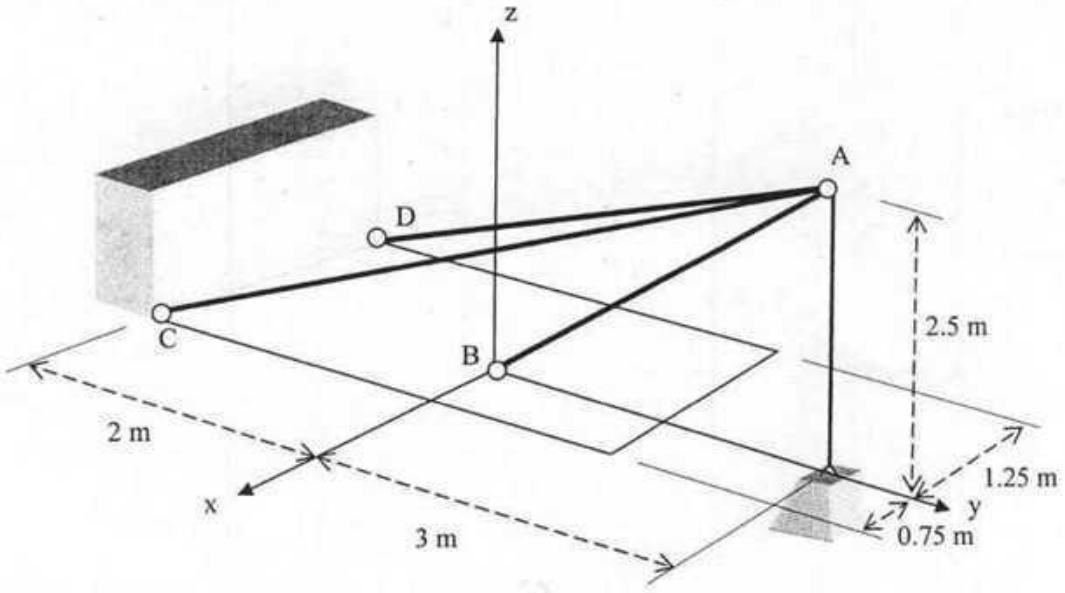


FIGURE 13

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

Course Title: Surveying | Credit Hours: 4.0 | Course Code: CE 105
Time: 3 hours | Full Marks: 100

SECTION I

(There are **Four** questions in this section. Answer any **Three** of them)

1. (a) Determine the azimuth and altitude of a star from following data: $(6\frac{2}{3})$

i. Declination of a star = 21°30′ N
ii. Hour Angle of a star = 40°
iii. Latitude of the observer = 50° N

(b) Calculate the earthwork for an embankment using the following data applying Prismoidal correction: (10)

Chainage (ft)	0	100	200	300
Ground Level (ft)	8.4	14	20.4	20
Formation Level (ft)	15	15	15	15

Formation level width = 100 ft. Side slope = 2 horizontal to 1 vertical

2.(a) Define "*Relief Displacement*". Derive an expression for relief displacement. $(4\frac{2}{3})$

(b) Compare between *Horizon System* and *Independent Equatorial System* with neat sketch. (2)

(c) A tacheometer fitted with an anallatic lens was set up at A. The following observations were made on a vertically held staff: (10)

Instrument Station	Staff Point	Whole Circle Bearing	Vertical Angle, Θ	Reading		
A	X	45°30′	0	3	3.625	4.25
A	P	32°30′	-2 °30′	2.25	3.75	5.25
A	Q	212°30′	+ 3°30′	1.2	3.25	5.3

R.L. of X is 36 ft. AX = 100 ft.(horizontal distance)

Determine the following:

i. Tacheometric constants.
ii. R.L. of P & Q.
iii. Horizontal distance between P & Q.

3. (a)Define " Picture Plane" and "Principal Point" with respect to terrestrial photogrammetry with a neat sketch. (3)

(b) The ground length of a line AB is known to be 550 m and the elevations of A and B are respectively 500 m and 300 m above mean sea level. On a vertical photograph taken with a camera having focal length of 20 cm include the images a and b of these points, and their photographic co-ordinates are :

$x_a = +2.65$ c.m. ,$y_a = +1.36$ c.m.
$x_b = -1.92$ c.m. ,$y_b = +3.65$ c.m.

The distance ab scaled directly from the photograph is 5.20 c.m. Compute the flying height above the mean sea level. (10)

(c) A line AB, 4000 m long lying at an elevation of 500 m measures 10 cm on a vertical photograph for which focal length is 20 cm. Determine the scale of the photograph in an area the average elevation of which is 900 m. $(3\frac{2}{3})$

4.(a) Why curvature correction is required for calculating volume using prismoidal and trapezoidal formulae ? Derive an expression for curvature correction applying Pappus' theorem. $(5\frac{2}{3})$

(b) Find the shortest distance between two places A and B , given that the latitude of A and B are 23.5° N and their longitudes are respectively 120°W and 70°E .Find also the direction of B on the great circle route. (11)

SECTION II

(There are **Five** questions in this section. Answer any **Four** of them)

1. (a) Explain how will you continue chaining past the following obstacles: (5)
   i. a hill
   ii. a river

   (b) The following bearings were observed with a compass. Calculate the interior angles. (7.5)

Line	Fore Bearing
AB	60°30′
BC	122°0′
CD	46°0′
DE	205°30′
EA	300°0′

2. (a) Explain the "closing error" of a compass survey. Show how you can adjust it by Graphical Method. (2+6)

   (b) The true bearing of a tower as observed from a station A is 348°38′ and the magnetic bearing of the tower as observed by a theodolite is 2°15′. The magnetic bearing of the line AB is also observed with the same instrument and found to be 148°26′. What is the true bearing of the line AB? (4.5)

3. (a) For a simple circular curve, define (4)
   i. Tangent distance
   ii. Deflection angle
   iii. Mid ordinate
   iv. Long chord

   (b) The following staff readings were observed successively with level, the instrument having being moved forward after the second, fourth and eighth readings:
   0.875, 1.235, 2.310, 1.385, 2.930, 3.125, 4.125, 0.120, 1.875, 2.030, 3.765
   The first reading was taken with the staff held upon a benchmark of elevation 132.135m. Enter the above readings in a page of a level book and calculate the R.L. of the points. Apply the necessary checks. (8.5)

4. (a) What is contour? What are the uses of contour maps? (1+2)
   (b) Draw contour maps: (1.5)
   i. an overhanging cliff
   ii. a pond
   iii. a ridge
   (c) What are the working operations of Plane Table Surveying? (3)
   (d) Derive curve setting out method by ordinates from the long chord (with figure). (5)

5. (a) What is local attraction? How it is detected and eliminated? (2.5)
(b) A street bend which deflects 33° is to be designed for a maximum speed of 27 mile per hour, a maximum centrifugal ratio of 0.25, width of road 9 ft and longitudinal gradient 40. The curve consisting of a circular arc combined with two transition curves. Calculate:
   i. The radius of the circular arc (2)
   ii. Length of transition curve (2)
   iii. Total length of the combined curve (3)
   iv. The chainage of the beginning and the end of the transition curve if the chainage of the P.I is 2554 m. (3)

Necessary Formulas for Spherical Triangle

1. $\cos P = \dfrac{\cos p - \cos a * \cos b}{\sin a * \sin b}$

2. $\tan(A+B)/2 = \cot(P/2) * \dfrac{\cos(a-b)/2}{\cos(a+b)/2}$

3. $\tan(A-B)/2 = \cot(P/2) * \dfrac{\sin(a-b)/2}{\sin(a+b)/2}$

Necessary Formulas for Curve Setting

1. Spiral angle, $S_a = (L_t/2\pi R)*180°$
2. Length of Transition curve, $L_t = hN$
3. Length of Circular curve, $L_c = (\pi R/180)*(\Delta - 2s_a)$
4. Length of Tangent, $L = (R+S)\tan(\Delta/2) + (L_t/2)$
5. Shift, $S = (L_t^2/24R)$

Note: Here the symbols have their usual meanings.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2013
Program: B.Sc. Engineering (Civil)

Course #: CE 107 (A) Course Title: Transportation Engineering I.
Full Marks: 120 Time: 3 hours

Answer any 6 (Six) from the following 7 (Seven) questions

1. a) Draw the Vicious Circle for Transportation-Land Use also Locate the point of intervention for sustainable solutions. (7)

   b) What are the category wise common bottlenecks or causes of congestion? (7)

   c) Explain the regulatory measures that are normally adopted in roadway traffic management. (6)

2. a) What are the forms of MRT and BRT? What are the advantages and disadvantages of MRT and BRT for a City like Dhaka? (6)

   b) What are the grade separated interchanges? Show any two interchanges in sketches. (6)

   c) Classify roadway and roadway intersection depending on different criteria. (8)

3. a) What are the factors that affect Diver's Characteristics? What do you understand by PIEV Time? (6)

   b) What are the objectives and benefits of Street Lighting? (6)

   c) A main business street, with 50ft pavement width having a reflectance of 10%, carries a maximum of 1000 vph at night-time in both directions. Design lighting system of the road considering mercury light source with mounting height of 40ft and a maintenance factor of 0.8. Draw the lighting layout. (8)

4. a) What do you think about the present locations and regulation management of Bus Terminals in Dhaka? In your view, how can it be improved? (6)

   b) What are the factors that affect Traffic Volumes? Explain the types of Traffic Flow. (6)

   c) A traffic engineer urgently needs to determine AADT on a rural primary road that has the volume distribution characteristics shown in tables attached. The engineer collected data shown below on a Monday during the month of June. Determine the AADT of the road. (8)

5. a) What are the scope and objectives of Traffic Volume Study? Explain the methods of Counting. (6)

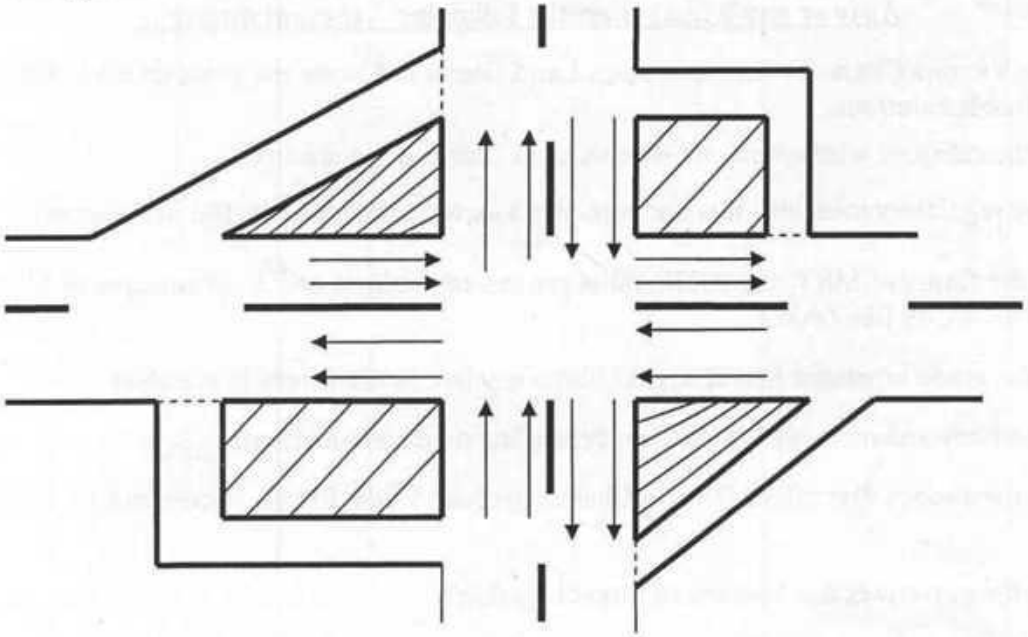
   b) What are the factors that affect Speeds? Explain different forms of speed. (6)

   c) Spot speed data were collected at a section of highway during a utility maintenance work. The mean speed before and after study are 35.5mph and 38.7mph, standard deviation for before and after study are 7.5mph and 7.4mph, and sample size before and after study are 250 and 280. Determine whether there was any significant difference between the average speeds at the 95% confidence level. (8)

6. a) What are the causes and types of delay that normally roadway traffic faces? (6)

b) Parking of vehicle should be prohibited in which locations? Explain common method of parking. (6)

c) Find out the best option, in your opinion, to effectively manage the traffic flow through the following intersection. (8)



7. a) What are the functional classes of traffic signs? What are the flaws in use of traffic signs in Bangladesh? (5)

b) What are the terminologies of isolated Traffic Signal design? Explain the problems of traffic signaling system in Dhaka. (5)

c) Design a two-phase signal of an isolated cross-junction for the following data: (10)

Amber in Sec	3			
Red-Amber in Sec	2			
Inter green, (i) in Sec	9 (N-S)	6 (E-W)		
Lost time, (I) in Sec	3 (N-S)	2 (E-W)		
Arrival Flow (pcu/hr)	550 (N)	650 (S)	900 (E)	800 (W)
Sat. flow (pcu/hr)	2200 (N)	2300 (S)	2800 (E)	3000 (W)

Equations:

$$Z = \frac{| u_1 - u_2 |}{S_d}$$

$$S_d = \sqrt{\frac{{S_1}^2}{n_1} + \frac{{S_2}^2}{n_2}}$$

$$C_0 = \frac{1.5L + 5}{1 - Y}$$

$$g_{NS} = \frac{y_{NS} * (C_0 - L)}{Y}$$

$$g_{EW} = \frac{y_{EW} * (C_0 - L)}{Y}$$

Where the symbols have their usual meanings.

Table 1 Hourly Expansion Factors for a Rural Primary Road

Hour	Vol.	HEF	Hour	Vol.	HEF
6:00-7:00 a.m.	294	42.01	6:00-7:00 p.m.	743	16.6
7:00-8:00 a.m.	426	28.99	7:00-8:00 p.m.	706	17.5
8:00-9:00 a.m.	560	22.05	8:00-9:00 p.m.	606	20.4
9:00-10:00 a.m.	657	18.8	9:00-10:00 p.m.	489	25.3
10:00-11:00 a.m.	722	17.11	10:00-11:00 p.m.	396	31.2
11:00-12:00 p.m.	667	18.52	11:00-12:00 a.m.	360	34.3
12:00-1:00 p.m.	660	18.71	12:00-1:00 a.m.	241	51.2
1:00-2:00 p.m.	739	16.71	1:00-2:00 a.m.	150	82.3
2:00-3:00 p.m.	832	14.84	2:00-3:00 a.m.	100	124
3:00-4:00 p.m.	836	14.77	3:00-4:00 a.m.	90	137
4:00-5:00 p.m.	961	12.85	4:00-5:00 a.m.	86	144
5:00-6:00 p.m.	892	13.85	5:00-6:00 a.m.	137	90.2
		Total daily volume =	12350		

Table 2 Daily Expansion Factors for a Rural Primary Road

Day of Week	Volume	DEF
Sunday	7,895	9.515
Monday	10,714	7.012
Tuesday	9,722	7.727
Wednesday	11,413	6.582
Thusrday	10,714	7.012
Friday	13,125	5.724
Saturday	11,539	6.51
	Total weekly volume =	75,122

Table 3 Monthly Expansion Factors for a Rural Primary Road

Day of Week	ADT	MEF
January	1350	1.756
February	1200	1.976
March	1450	1.635
April	1600	1.482
May	1700	1.395
June	2500	0.948
July	4100	0.578
August	4550	0.521
September	3750	0.632
October	2500	0.948
November	2000	1.186
December	1750	1.355
	Total yearly ADT volume =	28450
	AADT =	2371

TABLE 1 RECOMMENDED AVERAGE ILLUMINATION (LUMENS/FT^2)

Pedestrian traffic[1]	Vehicular traffic[2] (vph)			
	Very light (<150 vph)	Light (150 – 500 vph)	Medium (500 – 1,200 vph)	Heavy (>1,200 vph)
Heavy	-	0.8	1.0	1.2
Medium	-	0.6	0.8	1.0
Light	0.2	0.4	0.6	0.8

Notes: (1) Heavy: As on main business street
Medium: As on secondary business streets
Light: As on local streets
(2) Night hour flow in both directions

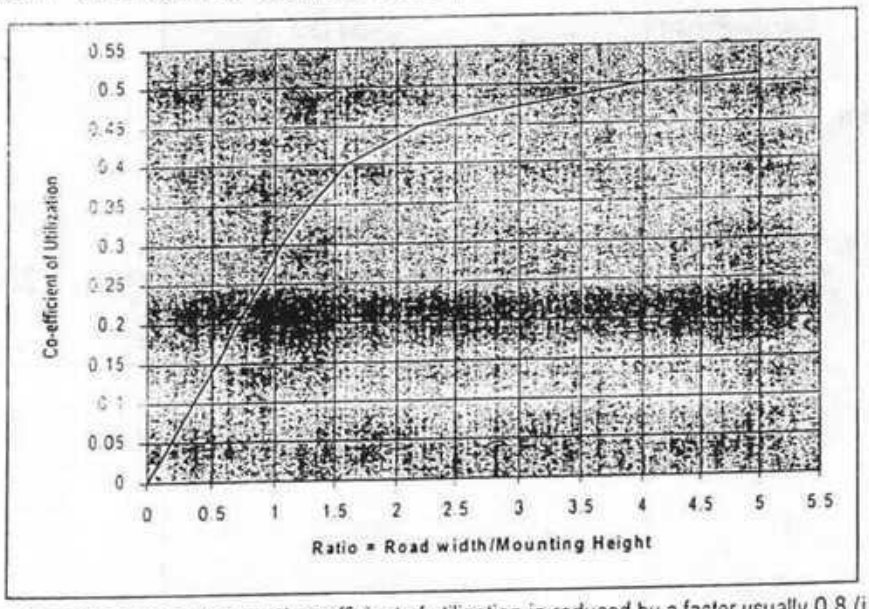
TABLE 2 ADJUSTMENT FACTORS FOR RECOMMENDED AVERAGE ILLUMINATION VALUES

Surface Reflectance	Adjustment Factors
3 % or less	1.5
10%	1.0
20% or more	0.75

TABLE 3 LIGHTING SOURCE CHARACTERISTICS

Source Types	Expected Life (hrs)	Lighting Efficiency (Lumens/Watt)	Wattage (Watt)
Tungsten	1000	8 – 14	Up to 1000
Fluorescent	6000	50 – 75	Up to 250
Sodium	6000	100 – 120	Up to 160
Mercury	7500	20 – 60	Up to 400

FIGURE 1 CO-EFFICIENT OF UTILIZATION CURVES *(FOR LIGHT DISTRIBUTION TYPE III)*



Note: Due to poor maintenance, the actual co-efficient of utilization is reduced by a factor usually 0.8 (i.e. taken as 80%)

TABLE 4 RECOMMENDED ARRANGEMENT OF STREET LIGHTING

Type of Arrangement	Pavement Width
One side	Width <= 30ft
Both sides – Staggered	30ft > Width <= 60ft
Both sides – Opposite	Width > 60ft

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2013
Program: B.Sc. Engineering (Civil)

Course #: **CE 107 (A)** Course Title: Introduction to Civil and Environmental Engg.

Full Marks: 100 Time: 2 hours

SECTION-I

Answer any **FIVE** questions from the following questions (5x14) =70

1. a) What is acid rain? Show in an idealized diagram some selected aspects of acid rain formation and paths. (6)
   b) What are the effects of acid rain? (4)
   c) Describe Meteorological and hydrological drought.(4)
2. a) Describe the sources of Air Pollution.(5)
   b)What are the types of air pollutants? Write short note about any one pollutant. (5)
   c) What are the general effects of air pollution? (4)
3. a) Briefly discuss the important urban environmental issues in Bangladesh. (6)
   b) Define renewable and non-renewable energy with examples. (4)
   c) Discuss values, knowledge and social justice as an environmental issue.(4)
4. a) What is Global Warming and how it occurs? Show with sketches. (5)
   b) How photochemical and sulfurous smog may be developed. (5)
   c) Describe possible effects of sea level rise in Bangladesh.(4)
5. a) Define water pollution? Write any four different categories of water pollutant along with their sources and impact. (10)
   b) Describe Ecosystem and Bio-diversity. (4)
6. a) Assume that a population follows a simple logistic growth curve. Find the maximum sustainable yield as a function of carrying capacity, the current population size and current growth rate. (10)
   b) Define age structure with sketch. (4)
7. Discuss different uses **OR** issues of water. (14)

SECTION-II

Assume any reasonable value, if at all required.

Answer any 3 (three) from the following questions.

$3 \times 10 = 30$

1. Discuss roadway classifications. What are the steps for procurement of works for a road construction project? (10)

2. Explain stress and strain. Show the stress strain behavior of a road surface and compare this with Hook's law. (10)

3. Briefly explain the specialties of civil engineering. What are the procedures to complete a building construction from start to finish? (10)

4. Write short note on any 4(four) of the following: (10)

   a) Traffic Management,

   b) Geotechnical Investigation,

   c) Shear Stress,

   d) Roadway Embankment,

   e) Dams and Levies.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2013
Program: B.Sc. Engineering (Civil)

Course #: **CE 107 (B)** Course Title: Introduction to Civil and Environmental Engg.

Full Marks: 100 Time: 2 hours

SECTION-I

Answer any **THREE** questions: (3x10=30)

1. a) What is acid rain? Show in an idealized diagram some selected aspects of acid rain formation and paths.
   b) What are the effects of acid rain?
2. a) Describe the sources of Air Pollution.
   b) What are the types of air pollutants? Write short note about any one pollutant.
3. Briefly discuss the important urban environmental issues in Bangladesh. Define renewable and non-renewable energy with examples.
4. What is Global Warming and how it occurs? Show with sketches, how photochemical and sulfurous smog may be developed.

SECTION-II

Assume any reasonable value, if at all required.

Answer any **5 (Five)** from the following **6 (sets)** of questions (14x5=70)

1. a) Draw a typical R.C.C Frame Structure and a Load Bearing Wall Structure. (5)

   b) What are the infrastructures that Civil Engineering mainly focuses on? (5)

   c) What are the disciplines of Civil Engineering? (4)

2. a) What is procurement? What are the 3 types of procurements? Discuss the process of (5)

engaging Consultants for a Bridge Construction Project.

b) Define transportation. What are the modes of transportation? What are the designs normally required for construction of a road connecting two places? (5)

c) A rubber is pulled at a stress of 4 MPa to elongate at a strain of 2 in/in and the rubber comes back to its original position after releasing. Find out the Modulus of Elasticity of the rubber using Hook's Law. (4)

3. a) Draw a complete Road Section showing layers and materials. (4)

b) Draw a flow chart showing the details of building construction starting from land survey. (5)

c) What do you understand by Traffic Engineering? Who should be responsible for managing traffic in a large city? (5)

4. a) What are the structures Transportation Engineers normally design and construct? (5)

b) What are the differences between the role of an architect and a civil engineer? (5)

c) Define civil engineering processes. (4)

5. a) Discuss the role of Geotechnical Engineers. (4)

b) Why do we need to construct piles for foundation? What are the other types of foundations for buildings? (5)

c) List construction materials normally used for construction of roads, bridges and buildings. (5)

6. Write short note on any 4(four) of the following: (14)

a) Global warming,

b) Soil classification,

c) Land survey,

d) Construction management,

e) Roof truss

f) Road materials

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
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 columns of UAP City Campus project at Firmgate based on the following data: (40)

Volume ratio of sand to total aggregate = 0.37
Air Content = 2 % (air-entraining admixture is not used)
Specific gravity of cement = 3 (OPC Cement)
Specific gravity of sand (SSD) = 2.6
Specific gravity of coarse aggregate (SSD) = 2.7
Design compressive strength (28 days) = 5000 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 0.5.

The following graphs are provided :

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

Answer the following:

(i) Prepare a trial mix of concrete based on the given data,
(ii) Calculate the unit weight of the proposed trial mix,
(iii) Prepare a mixture proportion table of the proposed trial mix,
(iv) Calculate the compaction factor of the mix,
(v) Calculate the volume ratio of the mix. Assume unit weights of cement, sand (SSD), and coarse aggregate (SSD) with void are 1400 kg/m^3, 1450 kg/m^3 and 1400 kg/m^3, respectively,
(vi) Calculate cost of concrete per cubic meter based on the current unit rates of materials,
(vii) How do you control the properties of materials (sand, coarse aggregate, cement, water, and admixture) to minimize variation of strength of concrete?
(viii) If at site, CEM Type II B-M cement is used instead of OPC (which was recommended in mix design), what changes in properties of concrete will occur.

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

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

Answer the following:

(i) Calculate FM of the samples (sand and stone chips),

(ii) Draw grading curves of the samples,

(iii) Discuss the possible ways to improve the FM of the samples to the recommended values,

(iv) Comment on the samples based on the sieve analysis data and grading curves, and

(v) From other source, another sand sample was collected and FM was found to be 3.2. In what proportions, the sand samples are to be mixed to achieve the required FM of sand?

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

3 (a) Refer to the following data associated with a sand sample: (3)

Volume of the OD sample = 1 m^3
Weight of the OD sample = 1400 kg
Bulk specific gravity (OD Basis) of the sand = 2.7
Absorption Capacity = 1%

Calculate the following:

(i) % Void in the sample and

(ii) SSD unit weight of the sample.

(b) Draw typical stress-strain curves of concrete for different strength (lower to higher). Explain the changes in mechanical properties of concrete with the change of strength. (2)

(c) Define the following mechanical properties of a material: (3)
(i) Toughness,
(ii) Stiffness, and
(iii) Malleability.

(d) Write a short note on worldwide consumption of concrete with its influence to the global environment. (3)

(e) Explain three harmful ingredients of bricks. (3)

(f) Write field tests (three tests only) of bricks. (3)

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

(h) Discuss the functions of lime, silica, and alumina in brick earth. (3)

4 (a) Draw the flow diagram of cement manufacturing process. (3)

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

(c) Compare fine cement and coarse cement with respect to the following: (3)
(i) Heat of hydration,
(ii) Early strength development, and
(iii) Long-term strength development.

(d) Explain hydration rate of C_23, C_3S, C_3A, and C_4AF of cement with time. What changes are to be made in clinker for making low heat cement, rapid hardening cement and sulfate resistant cement? (5)

(e) After testing a cement in a lab, the following results were found: (3)
Normal Consistency – 34%, Initial Setting Time – 50 minutes, and Final Setting Time – 400 minutes.
Explain the compliance of the cement as per ASTM.

(f) Write short notes on the following: (4)
(i) Flash setting of cement, and
(ii) False setting of cement.

5 (a) Discuss the role of mineral admixtures and chemical admixtures in concrete. (5)

(b) What is the significance of cover concrete in reinforced concrete structural members? "More cover concrete is necessary for structural members in contact with seawater" – Why? (3)

(c) Define workability of concrete. How is it measured? Discuss the effect of the following factors on workability of concrete: (3)
i) Shape of the aggregate,
ii) Cement content,
iii) W/C, and
iv) Fineness modulus of sand.

(d) "W/C ratio is a key factor related to strength and durability of concrete"- Explain briefly. (4)

(e) What are the purposes of using air entraining admixture in concrete? Is it necessary to use air entraining admixture in Bangladesh for general construction works? (4)

(f) Discuss the mechanism of improvement of workability of concrete with the addition of superplasticizer in concrete. (3)

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

(i) Cement content,
(ii) Sand to aggregate volume ratio,
(iii) Shape 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 following: (5)

(i) Self compacting concrete,
(ii) Porous concrete,
(iii) Maturity of concrete,
(iv) High strength concrete, and
(v) High performance concrete.

(d) Write short notes on the following: (6)

(i) Cold joint,
(ii) Construction joint,
(iii) Laitance,
(iv) Honeycomb,
(v) Segregation, and
(vi) Bleeding.

(e) Discuss the possible measures that are to be carefully considered for casting concrete in a hot environment. (2)

(f) Compare plastic shrinkage and autogeneous shrinkage of concrete. (2)

7 (a) Explain the process of initiation of corrosion of steel in concrete due to carbonation and chloride. (3.5)

(b) Discuss corrosion of steel in concrete with anodic and cathodic reactions. (4)

(c) Write the possible measures to stop early corrosion of steel bars in concrete in marine environment and atmospheric environment. (4)

(d) Write short notes on the following: (7.5)

i) Formation of annual rings of a tree,
ii) Use of plastic in Civil Engineering works,
iii) Production of natural rubber,
iv) Objectives of seasoning of timber, and
v) Use of rubber in Civil Engineering works.

(e) Discuss the following: (3)

i) Cathodic protection of steel in concrete by impressed current, and
ii) Cathodic protection of steel in concrete by discrete anode.

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

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

(c) Discuss the functions of each ingredient of varnish. (2)

(d) Explain different forms of moisture condition of aggregate. (2)

(e) Explain the empirical relationship between compressive strength and Young's modulus of concrete as per ACI. (3)

(f) Write short notes on the following: (9)

(i) Different methods for seasoning of timber,
(ii) Atomic packing factor for the face centered cubic unit cell,
(iii) Ingredients of paints,
(iv) Electroplating,
(v) Vulcanization, and
(vi) Atomic radius of body centered cubic unit cell.

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

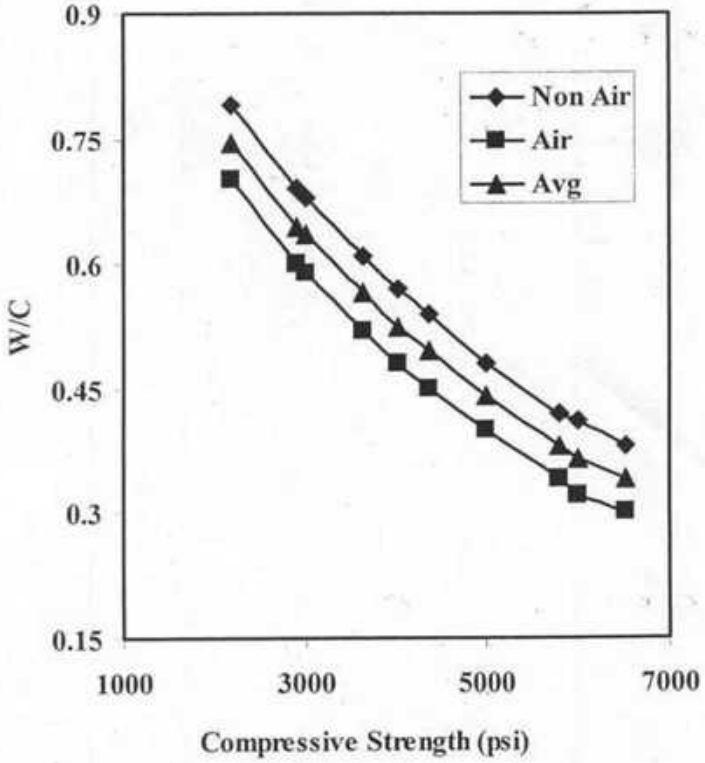


Fig. W/C versus Compressive Strength (aggregate type = stone chips)

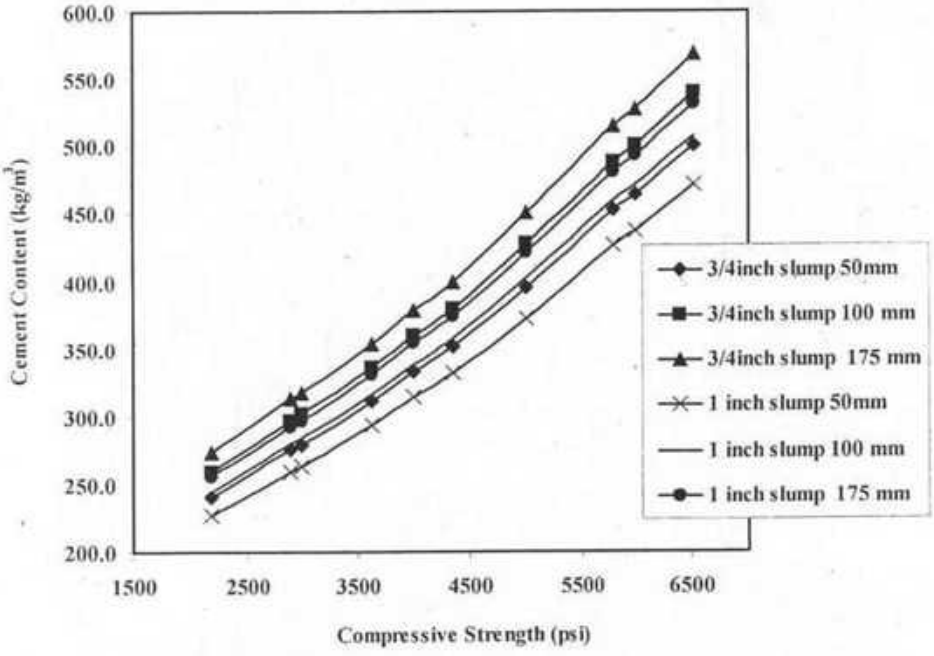


Fig. Cement Content versus Compressive Strength (aggregate type = stone chips)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

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

SECTION A

(There are **FOUR** Questions. **Answer THREE Questions including Question No. 1. Questions 1 is COMPULSORY)**

1. A concrete mix is to be designed using trial mix method (ACI method) for the construction of a slab of 5 inch thickness using the following data. **(35)**
   Design strength of concrete is 40 MPa (including safety factor).
   Maximum available coarse aggregate size is 25mm.
   Required slump value is 1 inch to 3 inch.
   Coarse aggregate has a dry rodded unit weight of 1360 kg/m^3.
   The water cement ratio is limited to 0.45 by durability criteria.
   Effect of absorption and moisture content of CA is negligible.
   Absorption capacity of FA is 1% and total moisture content of FA is 3%.
   FM of fine aggregate is 2.60. Fine sand is used as fine aggregate.
   Recommended dose of admixture is 0.9 litre/100 kg cement to reduce water requirement by 20%.
   Specific gravity of cement, admixture, CA(OD) and FA(OD) are 3.12, 1.2, 2.4, 2.2 respectively.
   i) Make mix proportion of concrete for 1st lab trial. 0.02 m^3 concrete is needed for 1st lab trial.
   ii) Using 1st lab trial mix result (Table 1) and graph 1 determine the volumetric ratio of cement, CA, FA and water. Properties of aggregate at site are given in Table 2.

2. (a) Write about the hydration characteristics of C_2S and C_3S with equation. **(6)**
   (b) Why slaking of lime is necessary? **(3)**
   (c) Discuss about the reinforcing mesh used in ferrocement with diagram. **(7)**
   (d) What is the advantage of using geotextile in construction of road embankment? **(4)**

3. (a) Write about the properties of two special types of mortar. **(5)**
   (b) Why sand is used in mortar? **(3)**
   (c) Discuss about bulking of sand. **(3)**
   (d) Describe about different types of sand based on source. **(9)**

4. (a) What are the advantage of using timber? **(3)**
   (b) Make a list of methods of artificial seasoning of timber. **(3)**
   (c) What factors must be considered during making choice of preservatives of timber.? **(4)**
   (d) Describe briefly about charring method. **(4)**
   (e) What are the causes of timber decay? **(4)**
   (f) Write about the difference between heart wood and sap wood. **(2)**

SECTION B

(There are **FOUR** Questions. **Answer any THREE Questions)**

5. Aggregate 1 and Aggregate 2 are combined in a ratio of 1:2 to form a mixture. Data derived (individual % retained) from the sieve analysis is given below.
   (i) Draw the sieve analysis graph in semi-log graph paper.
   (ii) Determine the Fineness modulus of the combined mixture. **(25)**

	Aggregate 1	**Aggregate 2**
Sieve (mm)	Individual % Retained	Individual % Retained
No.4(4.75mm)	7	0
No.8(2.36mm)	25	0
No.10(2.00mm)	5	12
No.16(1.18mm)	36	37
No.30(0.60mm)	10	23
No.50(0.30mm)	8	8
No.100(0.15mm)	9	20

6. (a) Write the names, chemical composition and notation of mineral constituents of cement. **(4)**
   (b) Write the difference between **(2.5+2.5)**
      i) Wet and Dry process of cement manufacture
      ii) False and flash setting
   (c) Draw the flow diagram of manufacture of cement. **(6)**
   (d) Describe about Rapid Hardening Cement and Quick Setting Cement. **(6)**
   (e) Discuss about the effect of fineness and soundness of cement. **(4)**

7. (a) Describe the causes and remedies of segregation of concrete. **(4)**
   (b) Define workability of concrete. Discuss the effect of water content and shape of aggregate on workability of concrete. **(5)**
   (c) "Slump test is unreliable for lean mix of concrete" – Explain briefly. **(4)**
   (d) Discuss the effect of water cement ratio and age on compressive strength of concrete. **(5)**
   (e) Write about maturity rule of concrete and its limitation. **(4)**
   (f) "Cube strength of concrete is greater than cylinder strength of concrete" – Explain. **(3)**

8. (a) Briefly describe the method of painting the surface of a new wood work. **(8)**
   (b) Write the difference between **(2.5+2.5)**
      i) Natural and artificial rubber
      ii) Natural and artificial seasoning of timber
   (c) Write about the constituents of paint. **(8)**
   (d) What is the importance of vulcanization of rubber? **(4)**

Table 1: First Lab trial mix result

Slump measured	60mm
Density of fresh concrete	2120 kg/m^3

Table 2:Properties of aggregates at site

Moisture content of fine aggregate	5%
Bulking of Fine sand	20%
Loose Dry Specific Gravity of CA	1.41
Loose Dry Specific Gravity of FA	1.32
Loose Sp. Gravity of cement	1.2

Table 3: ACI recommended dry rodded bulk volume of CA per m^3 of concrete.

Max aggregate size, mm	FM of FA (2.60)
9.5	0.48
12.5	0.57
19	0.64
25	0.69
37.5	0.73

Table 4: ACI recommended mixing water content for 1 m^3 concrete.

Max aggregate size,mm	12.5	20	25	40
Slump value,mm				
25 to 50mm	199	190	179	166
75 to 100	216	205	193	181
Air entrapped (%)	2.5	2	1.5	1

Formula for water cement ratio:

ACI recommended w/c ratio for normal strength concrete is $w/c = 1.1734e^{-0.0259f'c}$. f'c is in MPa.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

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

Section A

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

1. (a) What is geomorphic process? Classify (mention names only) geomorphic processes based on origin. Write down the names of major geomorphic agents. 5

(b) What are physical and chemical weathering processes? Discuss, in brief, the physical weathering processes. 7

(c) Give two examples of each type of major rocks. Discuss, in brief, sedimentary rocks. 8

2. (a) Classify (mention names only) major minerals. Mention the major properties of minerals. 4

(b) What is diastraphism? Draw neat sketch of a typical fold geometry showing its major features. 4

(c) Write short notes on folds, faults and joints and rock cleavage. 6

(d) Classify and discuss briefly (with neat sketches) any three types of folds. 6

3. (a) Classify (mention names only) faults and draw sketch of any two types of fault. 6

(b) Mention the aftermaths of liquefaction phenomenon. 4

(c) Classify and discuss briefly (no sketch required) different types of waves generated due to earthquake. 8

(d) Tabulate Modified Mercalli Intensity scales of earthquake (IX to XII). 2

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

(i) Schematic diagram of rock cycle
(ii) Principal zones of earth (names only) with a schematic diagram showing the thicknesses of different parts of lithosphere/geosphere.
(iii) Neat sketches of Oblique fault and Graben
(iv) Basic mechanism of liquefaction
(v) Major earthquake parameters (geometric) with neat sketches

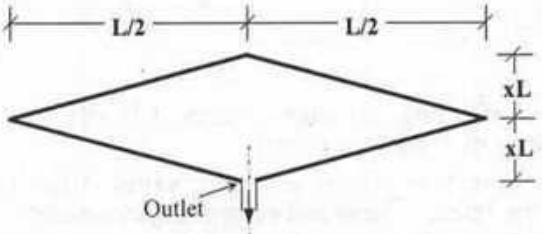
Section B

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

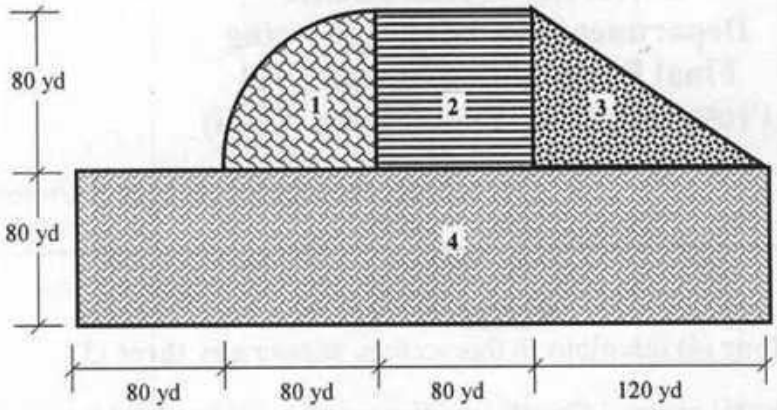
5. (a) Discuss, in brief, runoff. 3

(b) Mention the factors affecting runoff (no description is required). 3

(c) For the basin shown below, x is a constant factor. For what value of x, the flow rate (Q) will be the maximum for the basin? Find the FF and CC of the basin for maximum runoff. 8



(d) For the drainage area as shown in the next page, calculate peak runoff in m^3/s. Use C_1 = 0.8, C_2 = 1.0, C_3 = 0.5 and C_4 = 0.7 and I = 0.2 cm/min. 6



6. (a) What are the major causes of river erosion? Mention three hydraulic actions responsible for river erosion 3

(b) Prove that $d \propto v^2$; where symbols carry their usual meanings. 8

(c) Two rivers, river 1 (R_1) and river 2 (R_2) has velocity v_1 of river 1 about 4 times the velocity of river 2, v_1. Compare their sediment transport in terms of their maximum size. 3

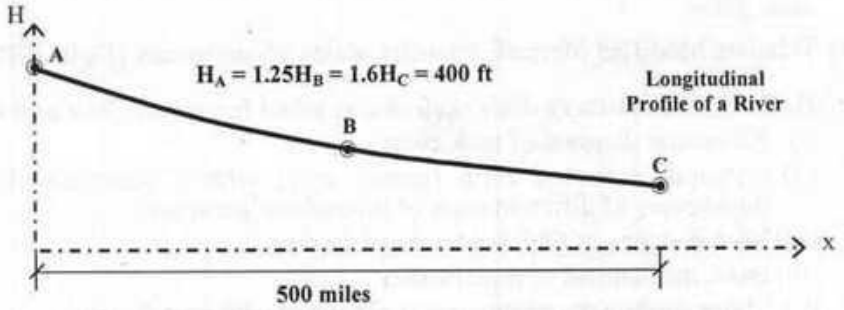
(d) Two locations of a river has slopes of 1:10000 (V:H) and 1:30000 (V:H) at locations 1 and 2, respectively. Hydraulic radius at location 1 is 3 times the hydraulic radius at location 2. Compare erosional tendency of the same river at these two locations. 3

(e) For a stream having triangular X-section and T <<<<< D, prove: $\tau \propto T$ 3

Where symbols carry their usual meanings.

7. (a) Define river transportation, load, capacity and competence. Write short notes on various types of loads of a river. 5

(b) From the following figure, calculate the horizontal distance between locations B and C. 4



(c) What is stream order/rank? Mention the laws of stream order/rank with diagram. 4

(d) Calculate Drainage Density (DD) of a catchment area (having SF = 1.067×10^{-3} /Km^2) from the information provided in the table below. 7

Stream Rank	No. of Streams (Ns_i)	BR	ABR	Mean Length (Lm_i, Km)	LR	ALR
1	---	2.5	2.722	---	3.0	2.222
2	8	2.667		30	1.667	
3	---	---		---	---	
4	---			---		

8. (a) Mention the factors affecting drainage pattern. Classify and discuss, in brief with sketches, any two types of drainage patterns. 8

(b) Sketch a typical cross-section of a river/stream valley. Classify (mention names only) valley according to the stage, genesis and controlling structures. 3

(c) Discuss, in brief, the ways valleys are deepened and widened. 9

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Department of Civil Engineering
Final Examination Spring 2013 (Section A)
Program: B. Sc. Engineering (Civil)

Course Title: Numerical Analysis and Computer Programming — Course Code: CE 205
Time: 3 hours — Full Marks: 90 (= 9 × 10)

There are **02 (TWO)** parts, **PART A** and **PART B**. Answer **BOTH** parts. The figures in right margin indicate full marks of the questions. Assume reasonable values for missing data only, if any.

PART A (Numerical Analysis)

[Answer any **06 (SIX)** of the following **08 (EIGHT)** questions.]

1. Using Cramer's rule find the solution of the following system of linear equations. **(10)**

$$3x + y + z = 3$$
$$2x + 2y + 5z = -1$$
$$x - 3y - 4z = 2$$

2. (a) Determine the root of the following equation

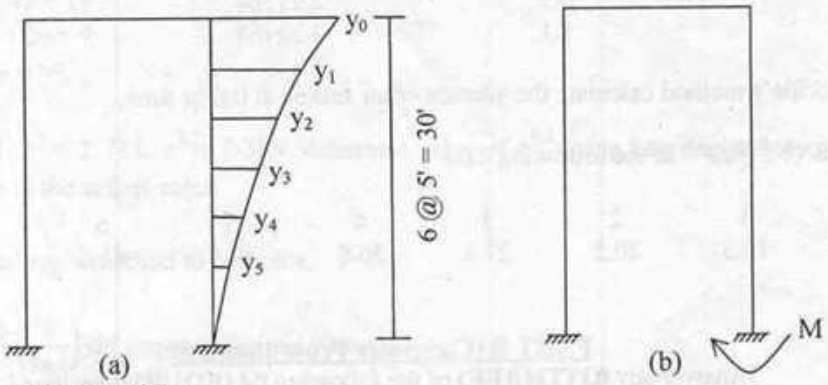
$$e^{x^2-1} + 10\sin(2x) - 5 = 0$$

using the bisection method between the interval [0,1] with $\varepsilon = 0.00001$. **(5)**

(b) Figure 1(b) shows distribution of force due to wind load on a 30' tall building. The ordinates of the force diagram are given below. **(5)**

Ordinate	y_0	y_1	y_2	y_3	y_4	y_5	y_6
Force (kip)	35	32	27	21	13	5	0

Using Simpson's 1/3rd rule find the moment M at the bottom of the base.



Distributed Force

Figure 1

3. (a) Using Newton-Raphson method find a solution of the following equation between the interval [1990,2000] with $\varepsilon = 0.00001$. **(5)**

$$5x + \ln x = 10000$$

(b) Evaluate the integral of the function using Trapezoidal rule **(5)**

$$I = \int_1^3 F(x)dx$$

x	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
F(x)	0.3679	0.2344	0.1291	0.0619	0.0259	0.0095	0.0031	0.0009	0.0002

4. Using Romberg's quadrature method integrate **(10)**

$$I = \int_1^2 \frac{1}{x} dx$$

Take at least up to eight intervals for better accuracy.

5. When a space shuttle leaves earth's atmosphere, during ascend, its decrement in the outside surface temperature can be expressed by the following ordinary differential equation **(10)**

$$\frac{dy}{dt} = y - t^2 + 1$$
$$y(0) = 0.5$$

Where y is temperature and t is time.
Find the temperature decrement from $t = 0$s to $t = 2$s with step size 0.5. Use Runge-Kutta method.

6. A spring system has resistance to motion proportional to the square of the velocity, and its motion is described by **(10)**

$$10\frac{d^2x}{dt^2} + \left(\frac{dx}{dt}\right)^2 + 6x = 0$$

if the spring is released from a point that is unit distance above its equilibrium $x(0) = 1$, $x'(0) = 0$, use Taylor's method to determine the value of x for $t = 1.5$s with step size 0.25.

7. Following table shows the amount of air that is being leaked from a balloon with respect to time

x(hr)	Amount of Air, f(x) (m^3)
0.3	0.404958
0.5	0.824361
0.7	1.40963
0.9	2.21364
1.1	3.30458

using Neville's method calculate the amount of air leaked at 0.6 hr time.

8. Fit the curve $Y = ae^{bX}$ to the following data **(10)**

X:	1	2	3	4	5	6	7	8
Y:	15.3	20.5	27.4	36.6	49.1	65.6	87.8	117.6

PART B (Computer Programming)

[Answer any **03 (THREE)** of the following **04 (FOUR)** questions.]

9. Write a program that can calculate the matrix summation of two n×n matrices. **(10)**

10. Write a program that calculates shear and moment at every 0.5 ft of a simply supported beam subjected to uniform load w. Moment and shear at x unit from left support are $wlx/2\text{-}wx^2/2$, $wl/2\text{-}wx$ respectively, l is the length of the simply supported beam. **(10)**

11. Write a program that calculates the summation **(10)**

$$S = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \ldots\ldots\ldots\ldots + \frac{x^n}{n!}$$

12. Write a program that takes three integer variables as input and interchanges them. **(10)**

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Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

Course Title: Numerical Analysis and Computer Programming | Course Code: CE 205
Time: 3 hours | Full Marks: 90

SECTION I

(There are **Nine** questions in this section. Answer any **Six** of them)

1. Observe that the following data seem to be fit by a curve $y = pe^{qx}$. Use least square method to determine the values of 'p' and 'q' for the following data. (10)

x	77	100	185	239	285
y	2.4	3.4	7.0	11.1	19.6

2. Solve the equation $\frac{dy}{dx} = x^2 - y^2$, with initial condition $y(0) = 1$ by Runge-Kutta method, from x=0 to x=0.3 with h=0.1 (10)

3. Using Regula-Falsi method, determine a root of the following equation within interval [1, 2]. Assume, ε=0.0001

   $e^x + 2^{-x} + 2\cos x - 6 = 0$ (10)

4. Solve the following system of linear equations by Gauss-Jordan method. (10)

   $4x + y - 3z = 11$
   $2x - 3y + 2z = 9$
   $x + y + z = -3$

5. If $e^0 = 1$, $e^1 = 2.718$, $e^2 = 7.389$, determine value of $e^{1.3}$ using Lagrangian Interpolation and compare to the actual value. (10)

6. Use Romberg's method to compute,

   $I = \int_0^{1.2} \left(\frac{1}{1+x}\right) dx$, upto 4 decimal places. (10)

7. In an examination the number of candidates who obtained marks between certain limits was as follows:

Marks	30-40	40-50	50-60	60-70	70-80
No. of Students	31	42	51	35	31

   Calculate the number of candidates whose scores were between 45 and 50 by Newton Gregory Forward difference method. (10)

8. The non-linear first-order Ordinary Differential Equation (ODE) governing unsteady radiation heat transfer per unit time from a mass can be expressed as follows:

$$\frac{dT}{dt} = -\alpha(T^4 - T_a^4)$$

Where, $\alpha = 4 \times 10^{-12}$, $T_a = 250, T(0) = 2500$
Solve the ODE for t = 4 by Euler's method, using step-size of 1. (10)

9. Evaluate the following integral using Simpson's one-third rule,

$I = \int_0^1 e^{-x^2} dx$, considering ten equal subdivisions. (10)

SECTION II

(There are **Four** questions in this section. Answer any **Three** of them)

10. 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. The program should print a message on screen if a=0. (10)

11. Write a program that can find the root of the following equation by Bisection method. (10)

$$f(x) = e^{-x} - \sin(\pi x/2)$$

12. Write a program to generate the first n terms of the Fibonacci series (1, 2, 3, 5, 8, 13...) (10)

13. Write a program that reads an integer number representing seconds and converts it into hour, minute and seconds. (10)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

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

There are fourteen (14) questions. Answer any ten (10)

1. Using section method, draw axial force, shear force and bending moment diagrams for the beam as loaded in Fig. 1.

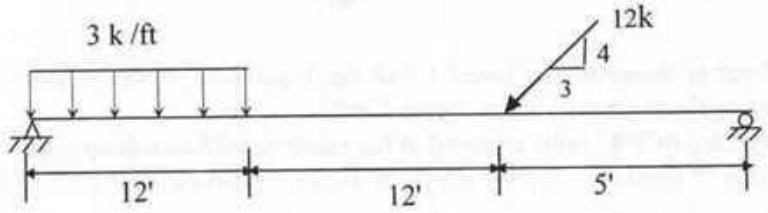


Fig :1

2. Using summation procedure, construct shear force and bending moment diagram for the beam with loads as shown in Fig. 2. Provide brief calculation.

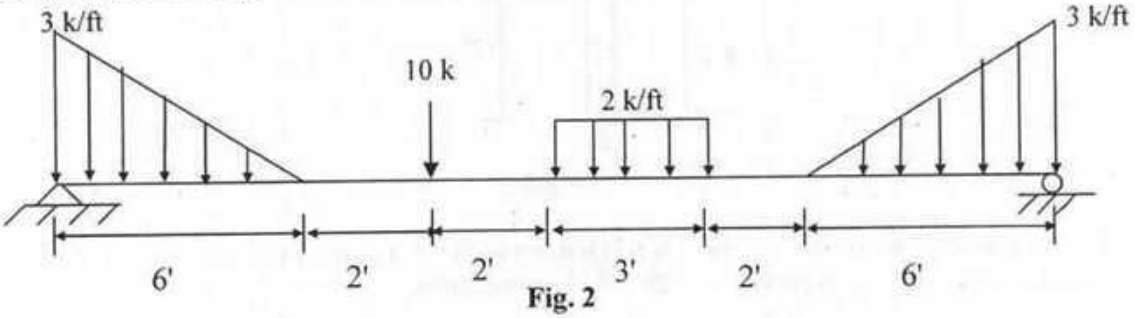


Fig. 2

3. Using singularity function, determine the expressions of shear force and bending moment for the beam loaded as shown in Fig.3. Hence draw shear force and bending moment diagram for the beam.

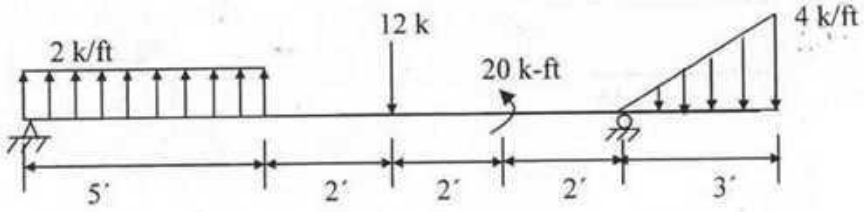


Fig.3

4. Calculate the reactions at supports in the following frame structure shown in Fig.4 and also find out the Axial Force, Shear Force and Bending Moment at section a-a.

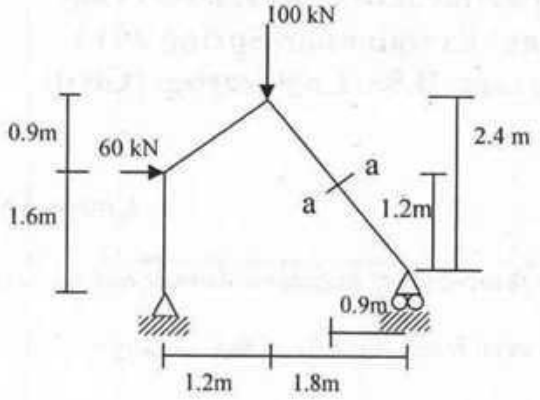


Fig.4

5. (i) Calculate the flexural shear flow at Level 1-1 of the T-sections joined as shown below in Fig 5 if loaded as the simply supported beam shown Fig 2.
(ii) Calculate the spacing of 7/8″ bolts required at the joints to withstand shear flow.
(iii) Calculate the size of welds required at the joints [Given: Allowable shear stress = 20 ksi].

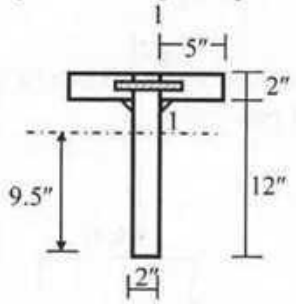
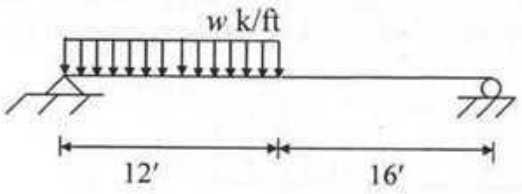


Fig.5

6. A beam is loaded as shown in the Fig.6. Determine the maximum allowable value of "*w*" if allowable stress is 15 ksi in tension and 20 ksi in compression.



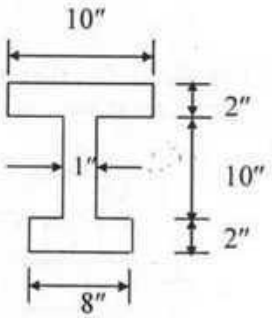


Fig.6

7. A steel beam with load is shown in Fig.7. Calculate shearing stress at levels indicated at section A-A. Also draw the shear stress distribution diagram.

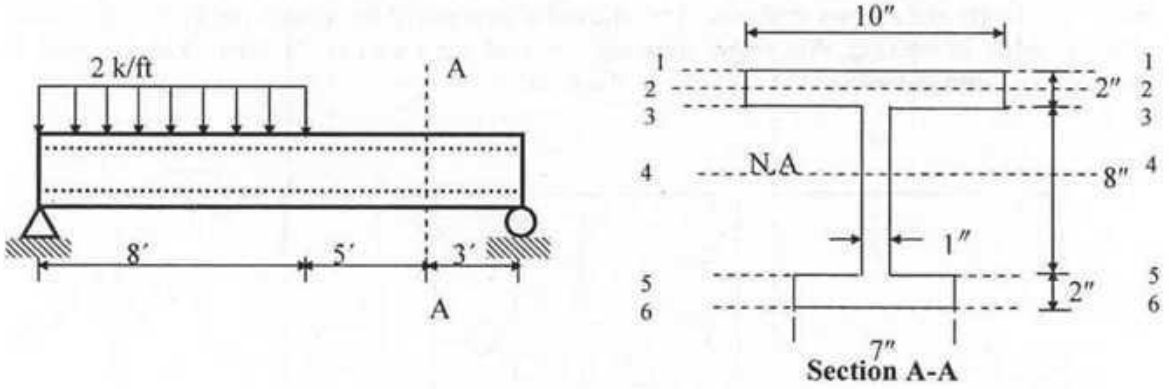


Fig.7

8. For a simply supported beam loaded as shown below in Fig 8, draw the flexural stress and strain diagrams over the composite cross-sectional area at section B.

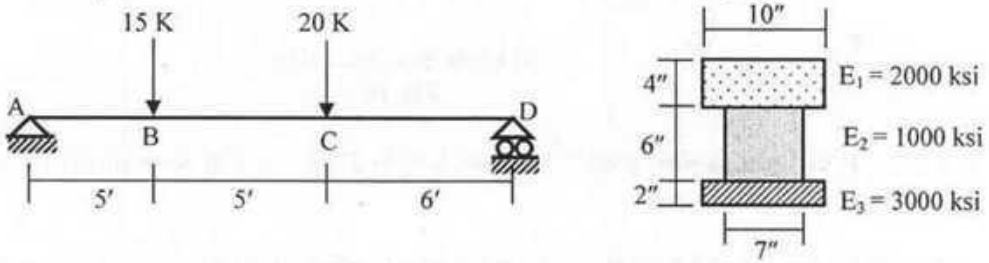


Fig. 8

9. A composite bar consists of an Aluminum section rigidly fastened between Bronze section and Steel section as shown in Fig. 9. Axial loads are applied as indicated. Determine the stress in each section. Also calculate the total change in length of the composite bar.
Given: E_{Steel}= 29,000 ksi, E_{Bronze}= 12,000 ksi and E_{Al}= 10,000 ksi.

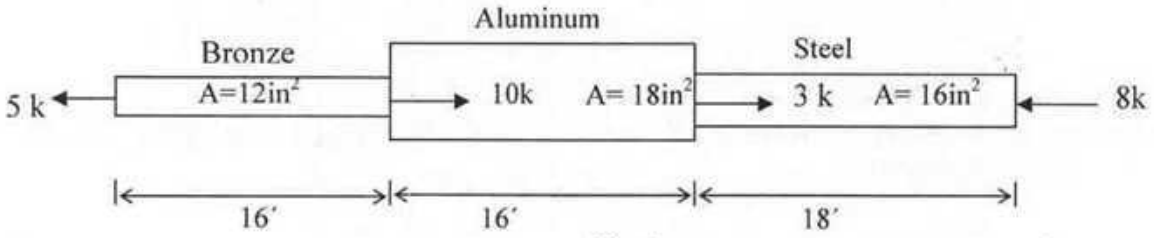
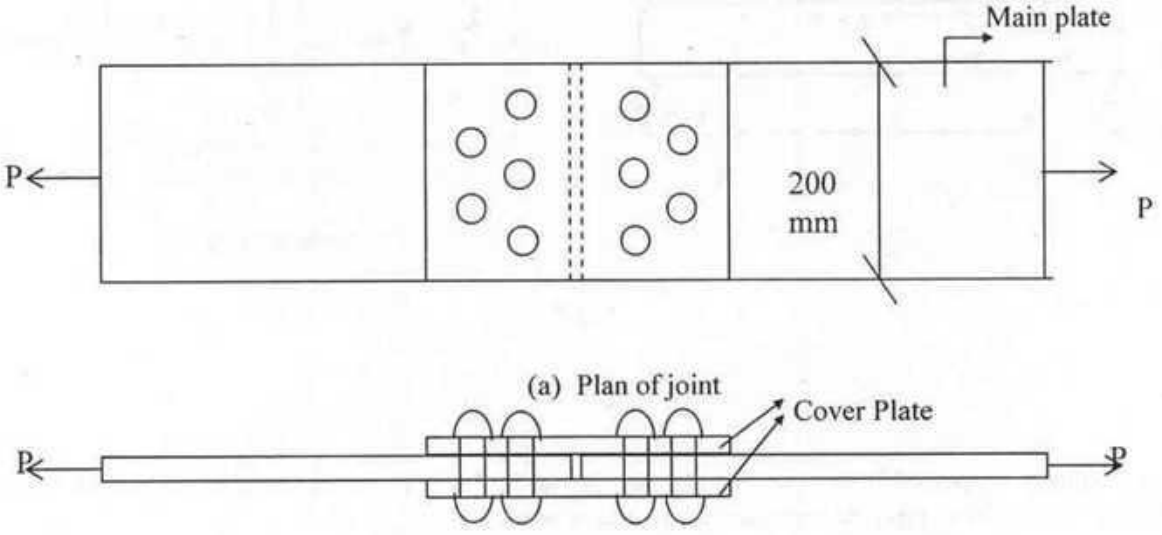


Fig. 9

10. Determine the safe capacity of the double-riveted butt joint shown in Fig.10 and hence the efficiency of the joint. The thickness of the main plate is 16 mm and that of cover plate is 10 mm each. The rivets are 20 mm diameter. The allowable stresses of the plates are 100 Mpa in tension and 130 Mpa in bearing. Allowable shearing stress of the rivets is 70 MPa. Assume rivet hole diameter is 3 mm more than the diameter of the rivet.



(b) Long Sectional View

Fig.10

11. a) Prove that in a thin walled pressure vessel, longitudinal stress is one half of circumferential or hoop stress.

b) Consider a closed cylindrical pressure vessel of radius 1000 mm and of 10 mm wall thickness. Determine the longitudinal and hoop stresses in the cylindrical wall caused by an internal pressure of 0.80 MPa. Also calculate the change in diameter of the cylinder caused by pressurization. Let E = 200 GPa and v = 0.25.Assume that $r_i = r_o = r$

12. 6. Briefly discuss the following terms
(a)Modulas of Elasticity (b)Modulas of Resilience (c)Yield Strength (d)Ultimate Strength (e)Modulas of Toughness

13 A L-3″×3″×0.5″ angle, which is to be welded to a gusset plate carries a load of 150 kips to a gusset plate along its centroidal axis.

(a) Determine the lengths of a side fillet welds required at the heel and toe of the angle for a non-eccentric connection. Assume that the allowable shearing stress through the throat of each weld is 21 ksi

(b) Resolve part (a) assuming that a fillet weld of maximum permissible size is added along the entire length of the end of the angle. (Use 5/16″ fillet weld for both calculation.)

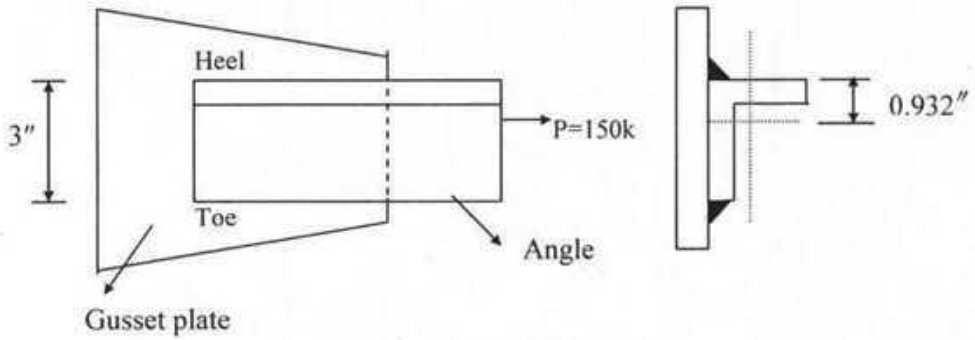


Fig: 11

14. Locate the Shear Center for the following beam. The thickness, t is constant throughout the section.

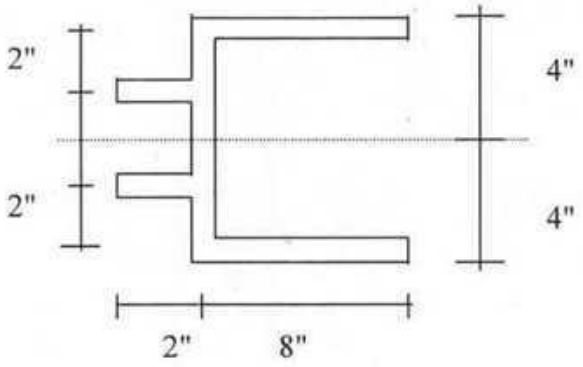


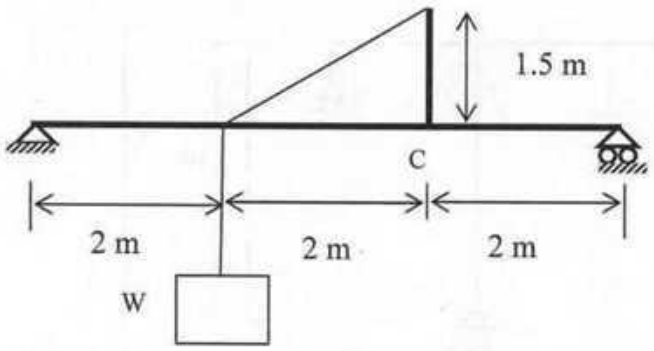
Fig: 12

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program : B.Sc Engineering (Civil)

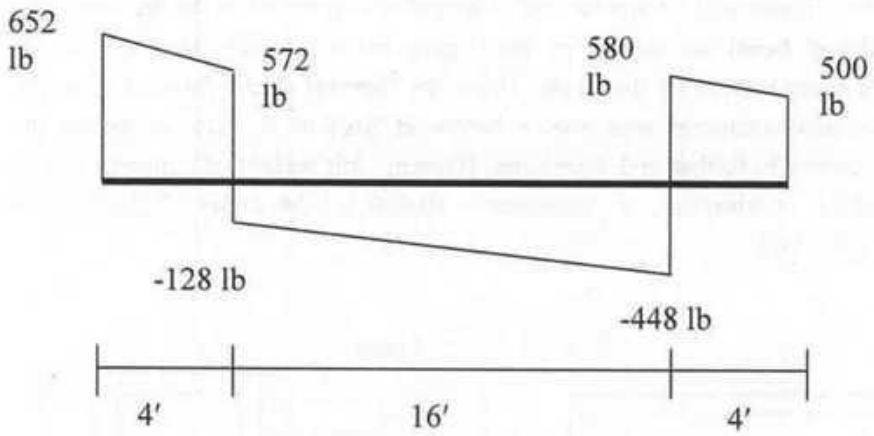
Course No: CE 211 — Course Title: Mechanics of Solids I
Full Marks: 100 — Time: 3.0 hours

There are seven questions. Question #1 is compulsory. Answer **Q.1 and any four**. The figures in the right margin indicate the marks of the questions.

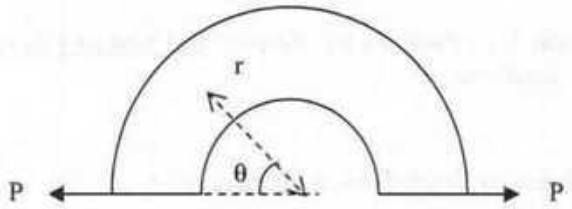
1.(a) The simply-supported beam is loaded by a weight W = 27 kN through the arrangement shown in the figure. The cable passes over a small frictionless pulley and is attached to the end of the vertical arm. Calculate the axial force, shear force, and bending moment at section C. **(5)**



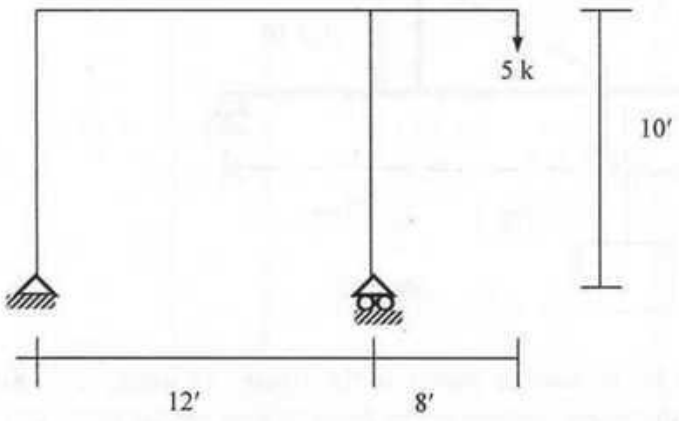
(b) The shear-force diagram for a beam is shown in the figure. Assuming that no couples act as loads on the beam, determine the forces acting on the beam and draw the bending moment diagram. **(5)**



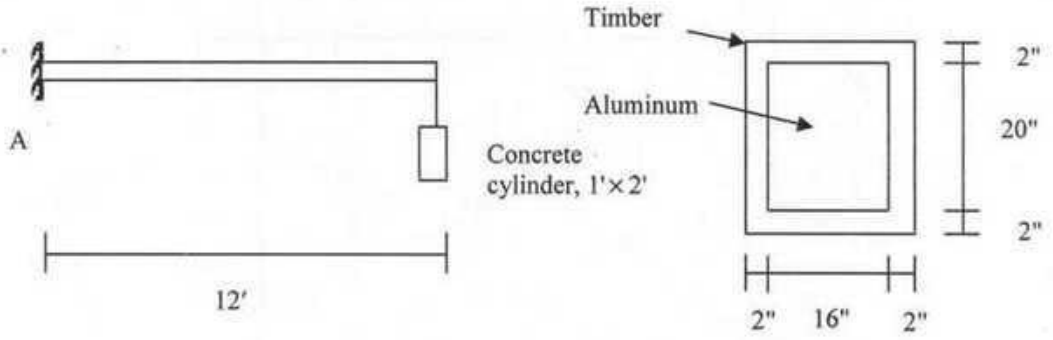
(c) A curved bar is subjected to loads in the form of two equal and opposite forces P, as shown in the figure. The axis of the bar forms a semicircle of radius r. Determine the axial force, shear force, and bending moment acting at a cross section defined by the angle θ. **(5)**



(d) Draw the SFD and BMD of the frame shown below. **(5)**

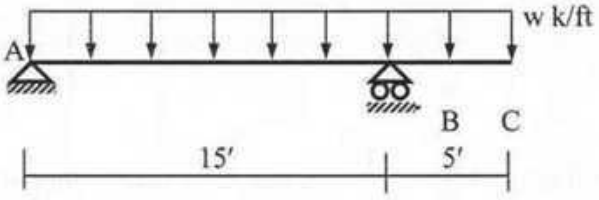


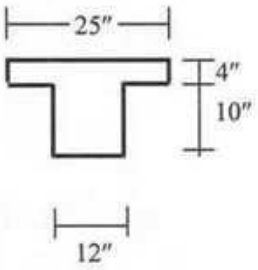
2.(a) A concrete cylinder of 1′ diameter and 2′ height is suspended at the free end of a 12′ cantilever beam as shown in the figure below, which also shows the composite cross-section of the beam. Draw the flexural strain diagram over the composite cross-sectional area shown below at Section A. Also calculate the maximum stress in timber and aluminum. [Given: Unit weight of concrete = 0.15 k/ft^3, Modulus of elasticity of aluminum = 10,000 ksi, Modulus of elasticity of timber = 2000 ksi]. **(12)**



(b) A cylindrical steel pressure vessel 500 mm in diameter with a wall thickness of 25 mm is subjected to an internal pressure of 6 MPa. Calculate the circumferential and longitudinal stresses and strains in the wall of the cylinder. Assume, Modulus of elasticity of steel = 30×10^3 ksi, Poisson's ratio = 0.25. **(8)**

3.(a) Calculate the maximum allowable value of w (k/ft) if the flexural shear stress over the cross-section is not to exceed 100 psi. Using the value of w, draw the shear stress diagram over the cross-section where the shear force in the beam is the maximum. Also calculate the section modulus, plastic section modulus and shape factor of the T-section [Given: Modulus of elasticity E = 30,000 ksi]. **(12)**



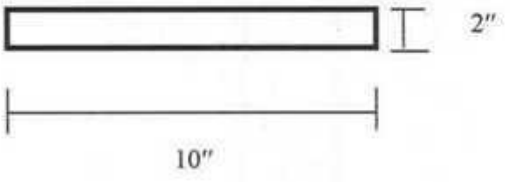


Cross Section

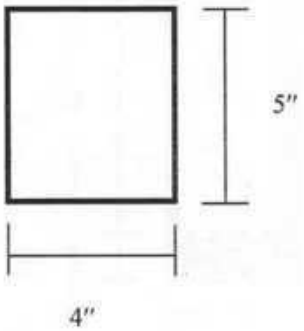
(b) What are the assumptions for thin walled pressure vessels? Explain generalized Hooke's law for isotropic material. **(8)**

4.(a) Derive a relationship for bending stress in a beam. **(8)**

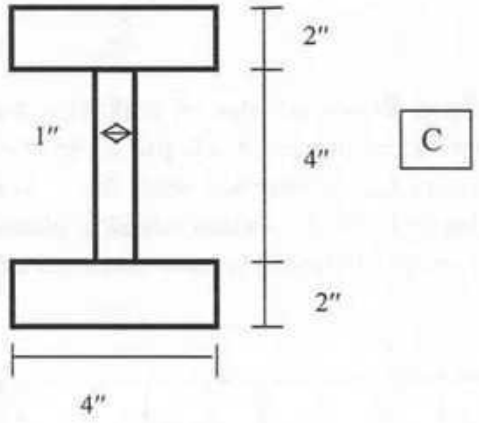
(b) A simply supported beam spans a distance of 12′ and carries a uniformly distributed load of 120 lb/ ft. Determine which cross section would be least stressed: A, B, or C. **(12)**



A



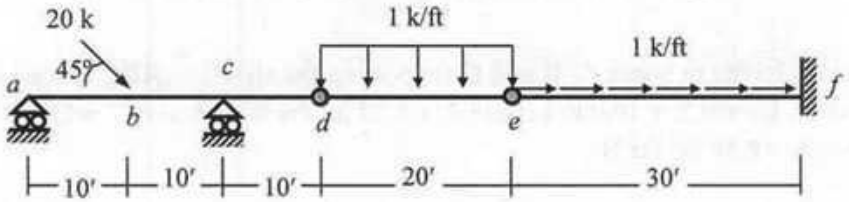
B



5(a) A nominal 2×10 (actual dims. $1\frac{1}{2}" \times 9\frac{1}{4}"$) is used as a simply supported beam with uniformly distributed load 140 plf. The allowable horizontal shear stress is 95 psi. Determine the maximum horizontal shear stress on the beam. Also determine if the beam is acceptable based upon allowable horizontal shear stress. **(10)**

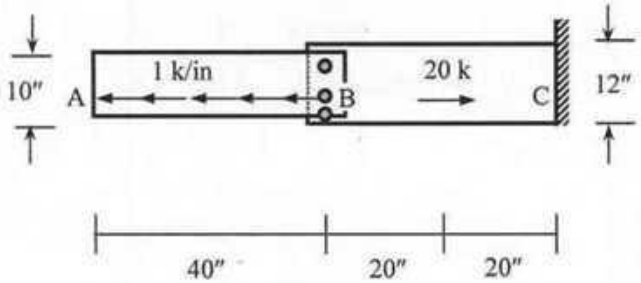
(b) A built-up plywood box beam shown in figure is held together by nails. Determine the spacing of the nails if the beam supports a uniform load of 200 #/ft along the 26-foot span. Assume the nails have a shear capacity of 80# each. **(10)**

6.(a) Draw the AFD, SFD and BMD of the beam loaded as shown below. **(14)**

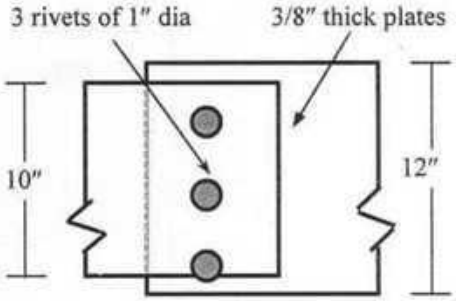


b) A beam with section modulus 40 in^3 experiences a moment of 95 kip-feet. The allowable bending stress for the steel beam is 24 ksi. Determine the maximum allowable moment. Also determine if the beam is acceptable or not based upon allowable bending moment. **(6)**

7.(a) Calculate the shearing stress in the rivets and maximum tearing and bearing stresses in the plates at joint B of the structural member ABC loaded as shown below. **(10)**

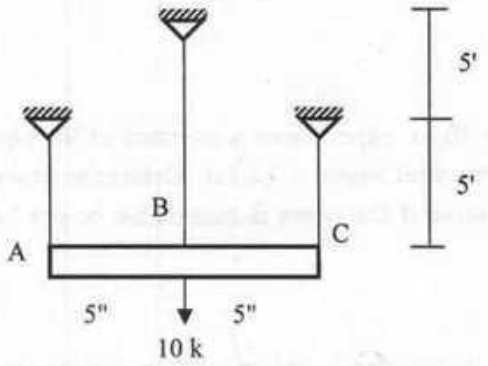


Member ABC



Joint B

(b) Calculate the forces in wires A, B and C supporting the rigid bar ABC loaded as shown below. Given: E = 10,000 ksi and A = 0.20 in^2 for wire A and C, while E = 30,000 ksi, A = 0.30 in^2 for B. **(10)**

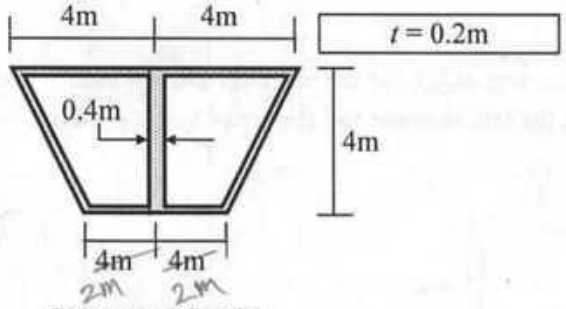


University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

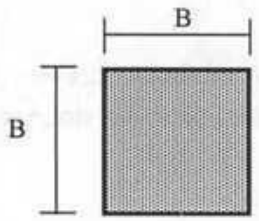
Course Title : Mechanics of Solids II — Course Code: CE 213
Time : 3 hours — Full Marks :10x10=100

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

1. If the compound section shown below is subjected to a 100 kN-m torque, calculate the
   (i) magnitude of maximum shear stress in the section
   (ii) depth and width (B) of the square section that has the same maximum shear stress when subjected to the same torque.

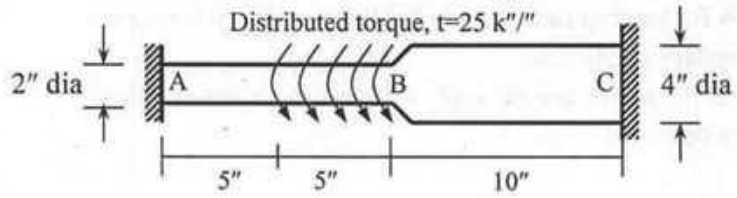


Compound Section

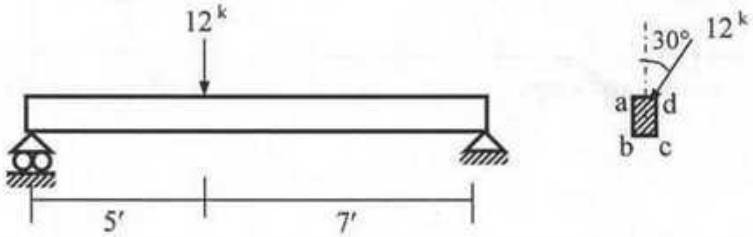


Square Section

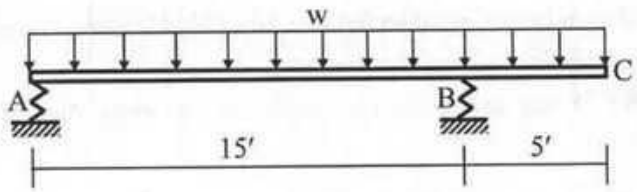
2. Calculate the torsional shear stress at C for the non uniform circular rod shown below (Neglect stress concentration)[Given G=12000 ksi]



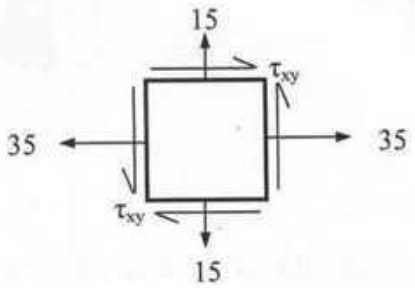
3. Calculate the maximum compound normal stress in the beam shown below (subjected to inclined loading) and show the point/points where it occurs [The beam area is a 0.5′× 1′ rectangle]



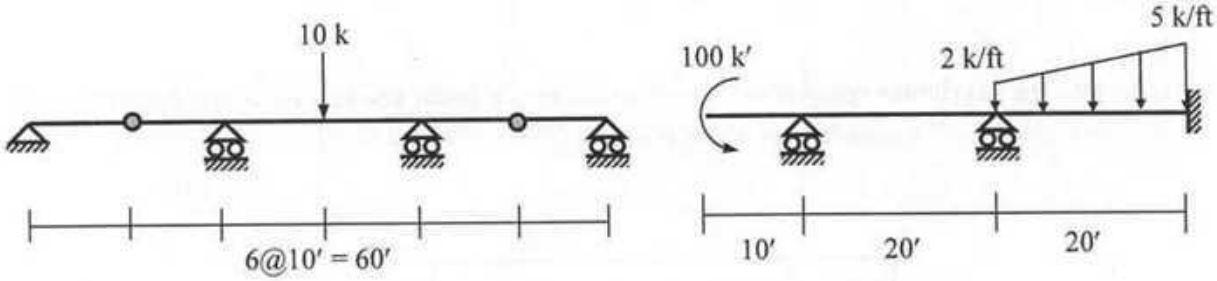
4. The figure below shows a rigid weightless beam ABC loaded as shown, being supported by helical springs A and B. If spring B deflects 1″ due to the superimposed load (w k/ft), calculate the values of
   (i) superimposed load, (ii) deflection of spring A, (iii) maximum shear stress at spring A
   [Given: The stiffness of spring A and spring B are similar. Both springs have coil diameter = 1″, average spring diameter = 5″, number of coils = 8 and shear modulus = 12000 ksi].



5. The maximum and minimum stresses (σ_{max} and σ_{min}) for the element shown below are related by $\sigma_{max} = 3\sigma_{min}$. Calculate the shear stress (τ_{xy}) for this element and draw the Mohr's circle of stresses.

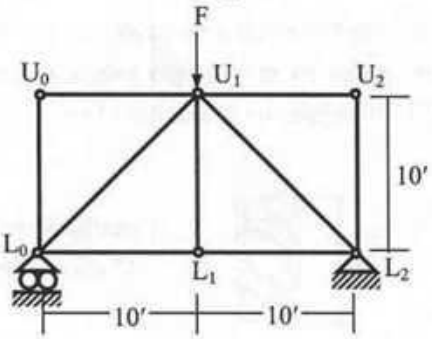


6. For the beams shown below,
   a) Write the expression for loading function w(x) using singularity functions,
   b) Write down the boundary conditions,
   c) Comment on whether the beams are statically determinate or indeterminate and
   d) Draw the qualitative deflected shapes.



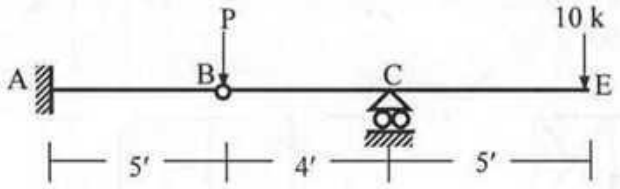
7. Derive the Euler formula of critical load for slender column and state the assumption used for deriving the formula.

8. Calculate the allowable value of F for the truss shown below using the AISC-ASD criteria. [Given: The truss members are hollow circular tubes of 4″ outside and 3″ inside diameter, E = 29000 ksi, f_y = 50 ksi for all members].

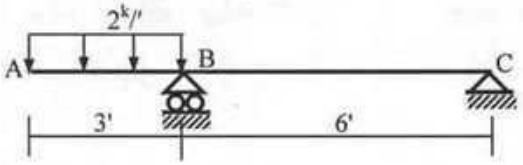


Cross-section

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

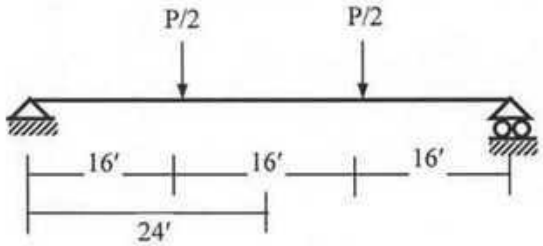


10. Use the conjugate beam method to calculate the deflection at A for the following beam. [EI_{AB} = 20,000 k-ft^2, EI_{BC} = 40,000 k-ft^2].

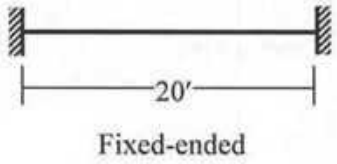


11. Solve Problem 10 using the Moment-Area Theorem.

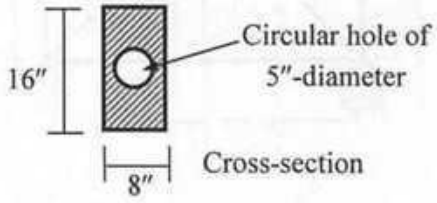
12. Calculate the value of P if the deflection at mid point is 6 inch downward. [Given: EI = 40×10^3 k-ft^2].



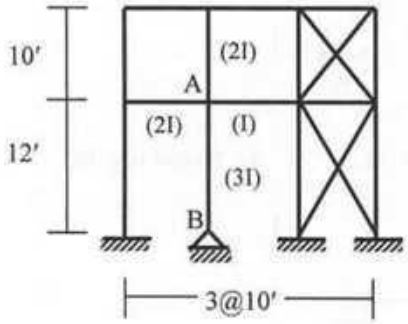
13. A 20-ft long fixed-ended column has a symmetric cross-sectional area as shown below and is made of a nonlinear material with stress-strain relationship given by $\sigma = \sigma_0 \sin(\varepsilon/\varepsilon_0)$, where σ is the stress (ksi) and ε is the strain. If $\sigma_0 = 4$ ksi and $\varepsilon_0 = 0.003$, calculate the critical load for the column.

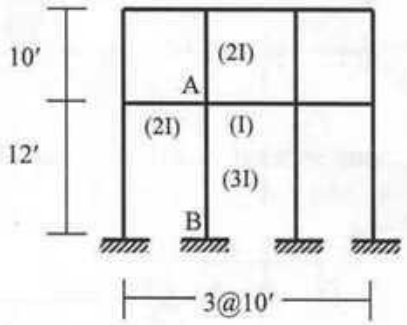


Fixed-ended



14. Refer to the following figure calculate the buckling load of column AB if the frame is (i) braced, (ii) unbraced [Given: EI = 40,000 k-ft^2].





List of Useful Formulae for CE 213

* Torsional Rotation $\phi_B - \phi_A = \int (T/J_{eq}G)\, dx$, and $= (TL/J_{eq}G)$, if T, J_{eq} and G are constants

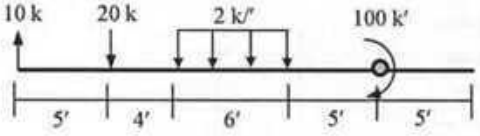
Section	Torsional Shear Stress	J_{eq}
Circular	$\tau = Tc/J$	$\pi d^4/32$
Thin-walled	$\tau = T/(2\textcircled{A}\, t)$	$4\textcircled{A}^2/(\int ds/t)$
Rectangular	$\tau = T/(\alpha bt^2)$	βbt^3

b/t	1.0	1.5	2.0	3.0	6.0	10.0	∞
α	0.208	0.231	0.246	0.267	0.299	0.312	0.333
β	0.141	0.196	0.229	0.263	0.299	0.312	0.333

* Biaxial Bending Stress: $\sigma_x(z, y) = M_z\, y/I_z + M_y\, z/I_y$
* Combined Axial Stress and Biaxial Bending Stress: $\sigma_z(x,y) = -P/A - M_x\, y/I_x - M_y\, x/I_y$
* Corner points of the kern of a Rectangular Area are (b/6, 0), (0, h/6), (−b/6, 0), (0, −h/6)
* Maximum shear stress on a Helical spring: $\tau_{max} = \tau_{direct} + \tau_{torsion} = P/A + Tr/J = P/A\,(1 + 2R/r)$
* Stiffness of a Helical spring is $k = Gd^4/(64R^3N)$

* $\sigma_{xx}' = (\sigma_{xx} + \sigma_{yy})/2 + \{(\sigma_{xx} - \sigma_{yy})/2\} \cos 2\theta + (\tau_{xy}) \sin 2\theta = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]} \cos(2\theta - \alpha)$
  $\tau_{xy}' = -\{(\sigma_{xx} - \sigma_{yy})/2\} \sin 2\theta + (\tau_{xy}) \cos 2\theta = \tau_{xy}' = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]} \sin(2\theta - \alpha)$
  where $\tan\alpha = 2\,\tau_{xy}/(\sigma_{xx} - \sigma_{yy})$
* $\sigma_{xx(max)} = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2,\ \alpha/2 + 180°$
  $\sigma_{xx(min)} = (\sigma_{xx} + \sigma_{yy})/2 - \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 \pm 90°$
* $\tau_{xy(max)} = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 - 45°,\ \alpha/2 + 135°$
  $\tau_{xy(min)} = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 + 45°,\ \alpha/2 - 135°$
* Mohr's Circle: Center $(a, 0) = [(\sigma_{xx} + \sigma_{yy})/2,\ 0]$ and radius $R = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$
* For Yielding to take place
  Maximum Normal Stress Theory (Rankine): $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$.
  Maximum Normal Strain Theory (St. Venant): $|\sigma_1 - \nu\sigma_2| \geq Y$, or $|\sigma_2 - \nu\sigma_1| \geq Y$.
  Maximum Shear Stress Theory (Tresca): $|\sigma_1 - \sigma_2| \geq Y$, $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$
  Maximum Distortion-Energy Theory (Von Mises): $\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 \geq Y^2$

* $M(x) = EI\,\kappa \cong EI\, d^2v/dx^2$
* $w(x) \cong EI\, d^4v/dx^4$, $V(x) = \int w(x)\, dx \cong EI\, d^3v/dx^3$, $M(x) = \int V(x)\, dx \cong EI\, d^2v/dx^2$
  $S(x) = \int M(x)\, dx \cong EI\, dv/dx \cong EI\,\theta(x)$, $D(x) = \int S(x)\, dx \cong EI\, v(x)$
* Singularity Functions for Common Loadings



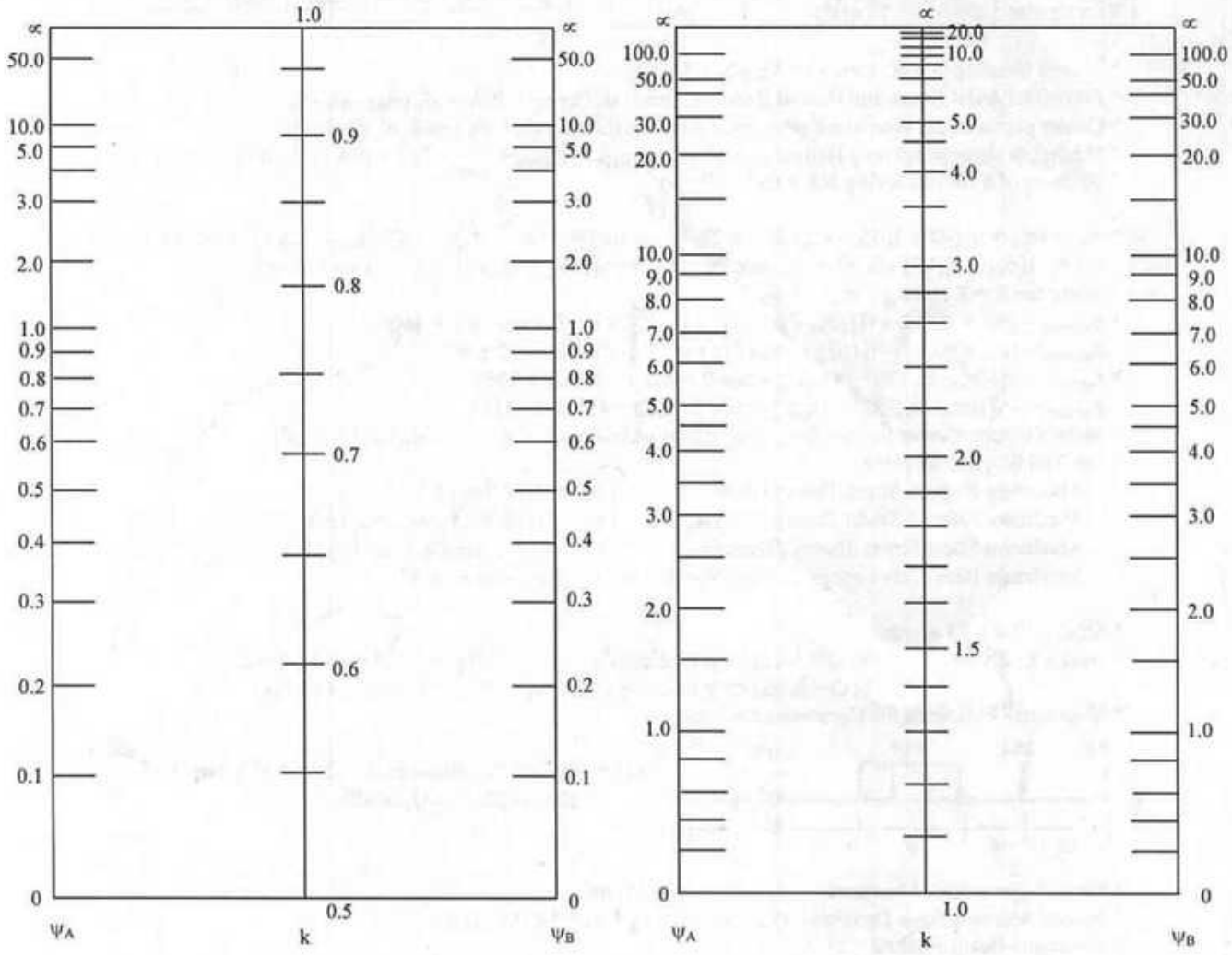
$w(x) = 10\langle x-0\rangle^{-1} \cdot -20\langle x-5\rangle^{-1} \cdot -2\langle x-9\rangle^{0} + 2\langle x-15\rangle^{0}$
$+ 100\langle x-20\rangle^{-2} \cdot + C_6\langle x-20\rangle^{-3} \cdot$

* First Moment-Area Theorem: $\theta_B - \theta_A = \int (M/EI)\, dx$
* Second Moment-Area Theorem: $(x_B - x_A)\,\theta_B - v_B + v_A = \int x\,(M/EI)\, dx$
* Conjugate Beam Method

Original Beam	Free End	Fixed End	Hinge/Roller End	Internal Support	Internal Hinge
Conjugate Beam	Fixed End	Free End	Hinge/Roller End	Internal Hinge	Internal Support

* Euler Buckling Load: $P_{cr} = \pi^2\, EI_{min}/(kL)^2$
* Effect of Initial Imperfection: $v(x) = v_0/[1 - P/P_{cr}] \sin(\pi x/L) \Rightarrow v(L/2) = v_0/[1 - P/P_{cr}]$
* Effect of Load Eccentricity: $\lambda^2 = P/EI \Rightarrow v(L/2) = e\,[\sec \lambda L/2 - 1] = e\,[\sec\{(\pi/2)\sqrt{(P/P_{cr})}\} - 1]$
* Effect of Material Nonlinearity: $P_{cr} = \pi^2\, E_t I/L^2 \Rightarrow \sigma_{cr} = \pi^2\, E_t/\eta^2$
* Eccentric Loading with Elasto-plastic Material:
  $v(L/2) = e\,[\sec\{(\pi/2)\sqrt{(P/P_{cr})}\} - 1]$ for the elastic range; and
  $v(L/2) = M_p/P - e$, for the plastic range
* k = 1.0 for Hinge-Hinged Beam, 0.7 for Hinge-Fixed Beam, 0.5 for Fixed-Fixed Beam, 2.0 for Cantilever Beam
  In general, k is obtained from ψ_A and ψ_B for braced and unbraced frames
* AISC-ASD Method, $\eta = L_e/r_{min}$, and $\eta_c = \pi\sqrt{(2E/f_y)}$
  If $\eta \leq \eta_c$, $\sigma_{all} = f_y\,[1 - 0.5\,(\eta/\eta_c)^2]/FS$, where $FS = [5/3 + 3/8\,(\eta/\eta_c) - 1/8\,(\eta/\eta_c)^3]$
  If $\eta > \eta_c$, $\sigma_{all} = (\pi^2\, E/\eta^2)/FS$, where FS = Factor of safety = 23/12 = 1.92
* Moment magnification factor for a Simply Supported Beam
  For concentrated load at midspan of $= [\tan(\lambda L/2)/(\lambda L/2)]$, subjected to end moments only $= [\sec(\lambda L/2)]$
  Under UDL $= 2\,[\sec(\lambda L/2) - 1]/(\lambda L/2)^2$, according to AISC code $= 1/(1 - P/P_{cr})$

Alignment Charts for Effective Length Factors k



Braced Frames

Unbraced Frames

ψ = Ratio of ∑EI/L of compression members to ∑EI/L of flexural members in a plane at one end of a compression member
k = Effective length factor

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013

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. 7** as compulsory and **any five** from the rest.

---

1. (a) Define the following terms (any two): (2X3=6)
   i. Unsteady flow
   ii. Steam line
   iii. Control volume.

   (b) What do you mean by stream function? Write down the characteristics and limitations of flow net. (3+6=9)

   (c) In a flow the velocity vector is given by $V = 2xi - 3yj + 5zk$. Determine the equation of the streamline passing through a point M (3, 1, 2). (10)

2. (a) Derive Bernoulli's energy equation. Also state its limitations. (10+3=13)

   (b) A liquid (S= 0.80) with a P_v= 26 kN/m^2, abs flows through the horizontal constriction as shown in figure 1. P_{atm} = 68 cm Hg. Find the maximum theoretical flow rate without cavitation to occur). Neglect head loss. (12)

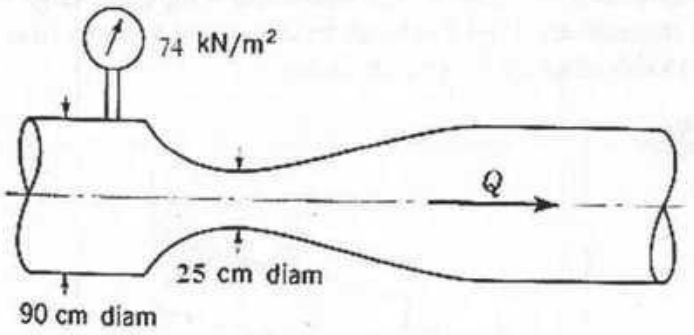


Figure 1

3. (a) Explain why a momentum correction factor is used. Also derive and expression for this factor. (3+5=8)

   (b) A Reaction Turbine has r_1 = 1.5 m, r_2 = 1.1 m, $\beta_1 = 50^0$, $\beta_2 = 140^0$, and thickness of 0.3 m parallel to the axis of rotation. With a guide vane angle of 20^0 and a flow rate of 12.0 m^3/s, calculate the required speed of the runner for smooth flow at inlet. For this condition also calculate:
   i. Torque exerted on the runner
   ii. Power developed
   iii. Energy extracted from each Newton of fluid. (17)

4. (a) Derive an expression for the drag force F_D exerted on a sphere as it moves through a viscous liquid by applying Rayleigh Method. (9)

   (b) A curved pipe section of length 10 m that is attached to the straight pipe section as shown in figure 2. Determine the resultant force on the curved pipe, and find the horizontal component of the jet reaction. All significant data are given in the figure. Assume an ideal fluid with γ = 8.80 kN/m^3. (16)

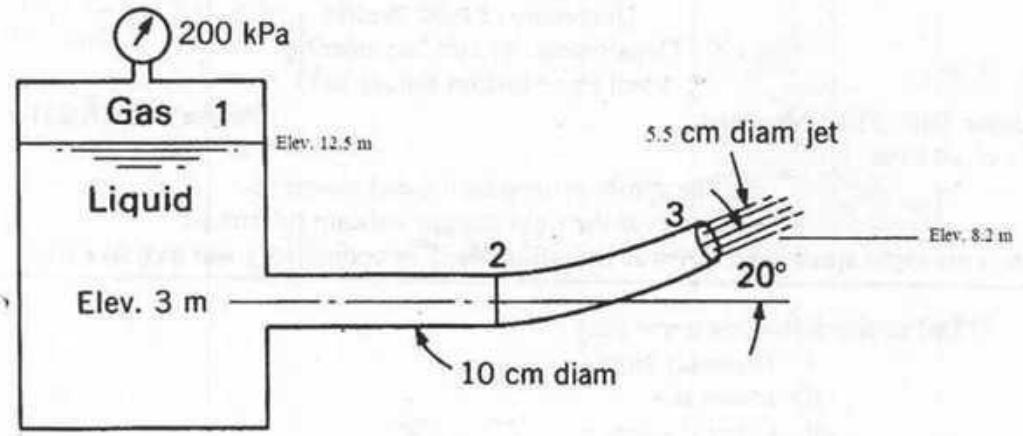


Figure 2

5. (a) 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 15 m of its length from the tank, the pipe is 20 cm in diameter and its diameter suddenly enlarges to 45 cm. The height of water level in the tank is 12 m above the center of the pipe. Considering all losses of head that occurs, determine the rate of flow. Assume f = 0.025 for both the pipes. (8)

(b) Two reservoirs with a difference in water surface elevation of 10 m are connected by two pipes in series as shown in figure 3. The equivalent roughness heights of the two pipes are 2.2 and 0.5 mm respectively. Find discharge by equivalent velocity head method. Given $\nu = 3\times10^{-6}$ m^2/s. Use Moody diagram for friction factor. (17)

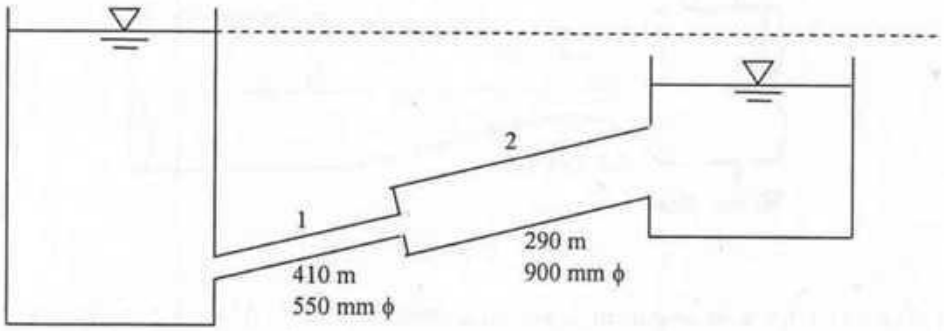


Figure 3

6. (a) Water is flowing through the pipe system as shown in figure 4. The pipe length, diameter and friction factor are given in figure. For a total discharge of 0.80 m^3/s, find flow through each pipe, head loss from B to C and pressure at C assuming P_B = 200 kN/m^2 and Z_B-Z_C = 5 m. (17)

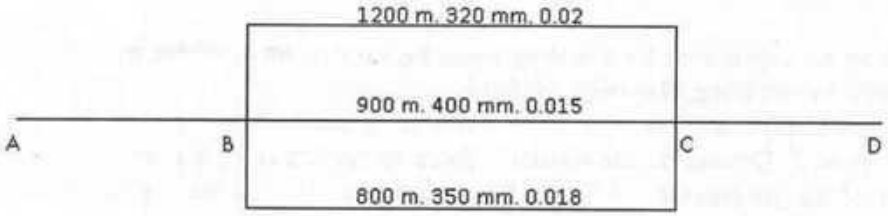


Figure 4

(b) If the flows into and out of a two-loop pipe system are as shown in figure 5, determine the flow in each pipe. The k-values for each pipe are given in the figure. Use Hardy Cross method. (8)

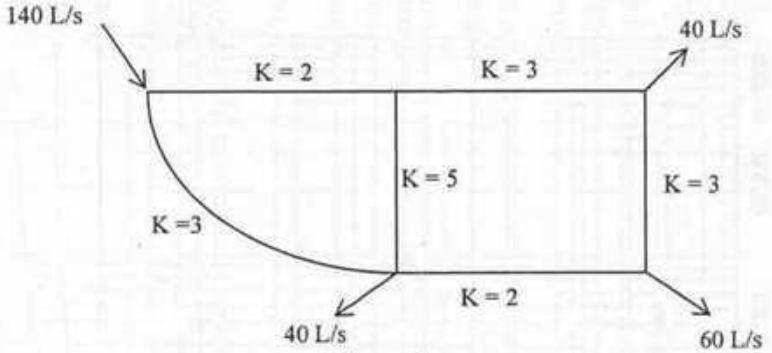


Figure 5

7. (a) Explain Reynolds experiment to distinguish between laminar and turbulent flow with a sketch. Also define critical Reynolds number. (6+4=10)

(b) A pipeline with a pump leads to a nozzle as shown in figure 6. Find the flow rate when the pump develops a head of 24 m. Assume that the head loss in the 15-cm diameter pipe may be expressed by $h_L = 5V_1^2/2g$, while the head loss in the 10-cm diameter pipe is $h_L = 12V_2^2/2g$. Sketch the energy line and the HGL, and find the pressure head at the suction side of the pump. (15)

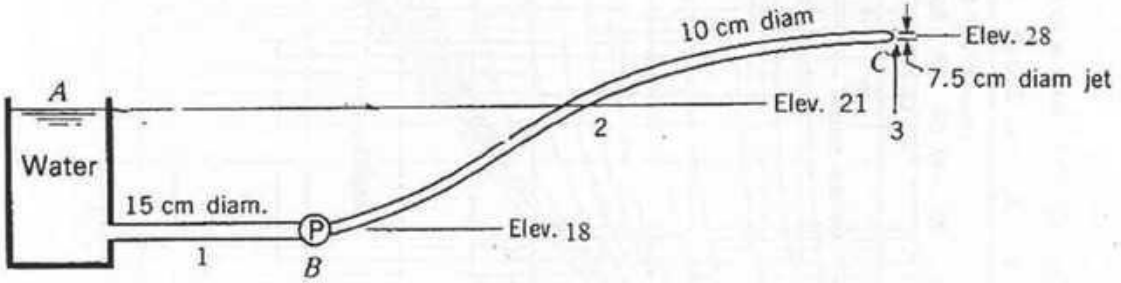


Figure 6

8. (a) Write short note on the following items:
   i. Coefficient of contraction
   ii. Head loss in orifice
   iii. Hydraulically smooth boundary. (3X3=9)

(b) What do you mean by dynamic similarity? State the use of dimensional analysis in fluid mechanics. (4+5=9)

(c) Prove that theoretical discharge through a venturimeter is given by

$$Q_t = \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \sqrt{2gh} \qquad (7)$$

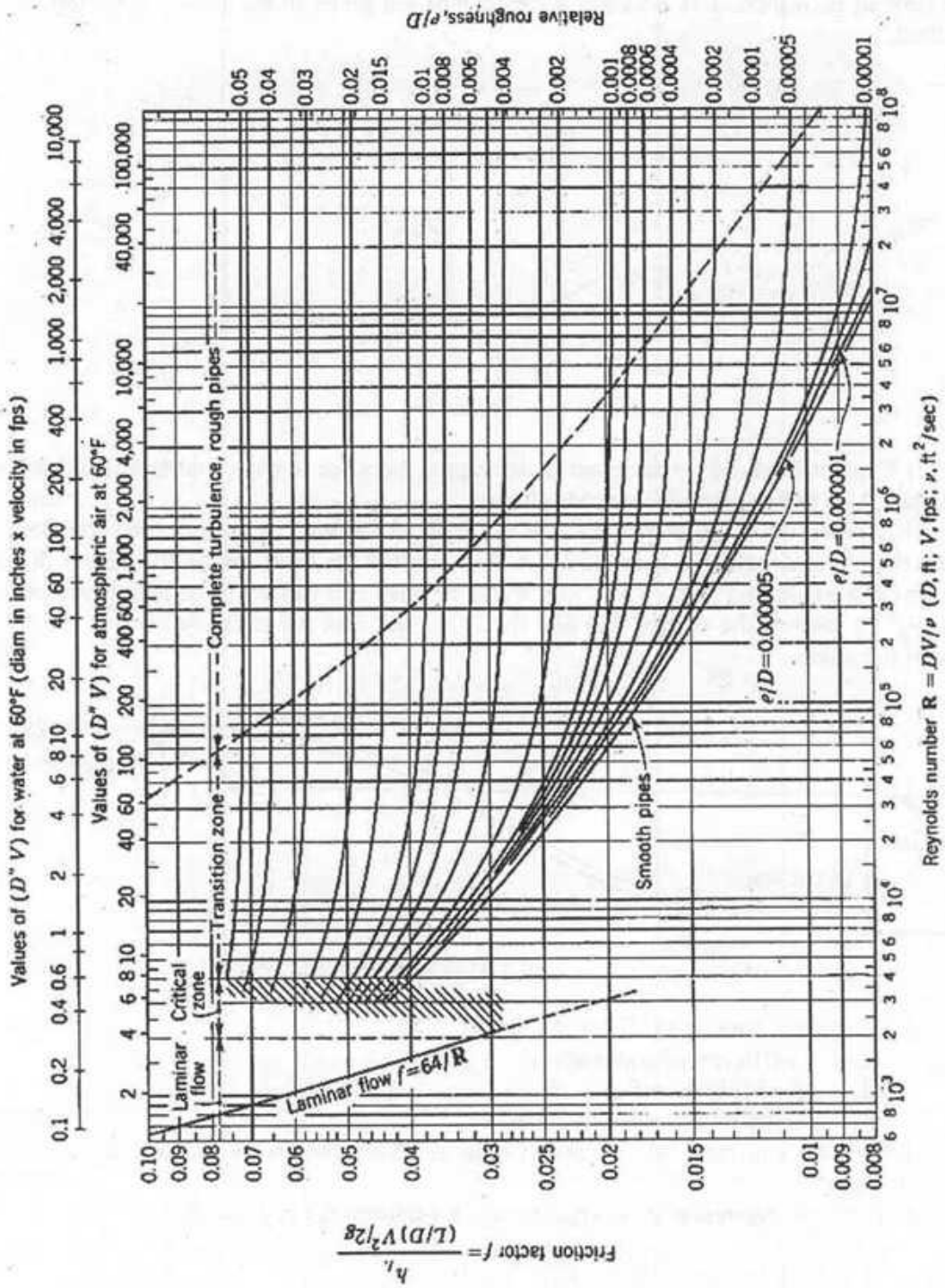


Figure 7: friction factor for pipes (Moody Diagram)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

Sec. A

Course Title: Fluid Mechanics I | Credit Hours: 3.0 | Course Code: CE 221
Time: 3 hours | Full Marks: 100 (= 5 × 20)

[Answer **any 5 (five)** of the following 7 (seven) questions. Assume any reasonable data for missing values.]

1 (a) Derive the Bernoulli's equation for incompressible fluid flow. (8)

(b) Find the total force acting on the gate per m length, which is a quadrant of a circle of radius 4 m (as shown in Figure 1). At what angle will it be acting to the horizontal? (7)

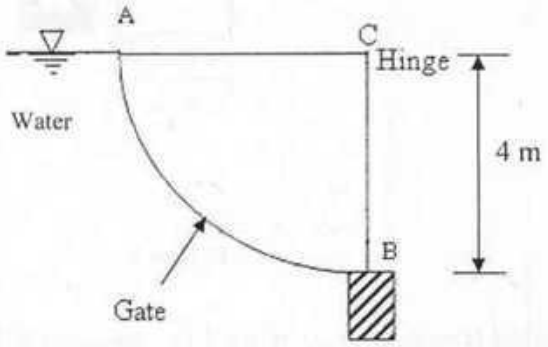


Figure 1

(c) Define "Absolute Pressure." Calculate the pressure difference between point A and B of Figure 2. Given specific weight of water is 9.81 KN/m^3 . (1+4 =5)

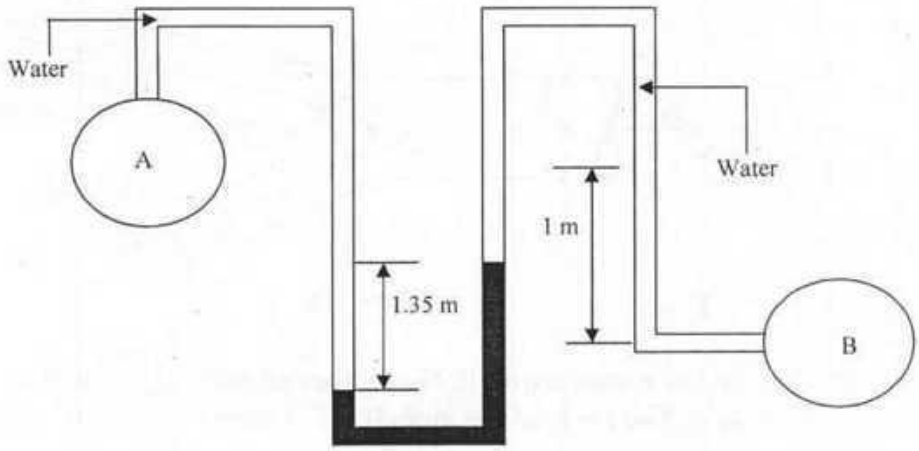


Figure 2

2.(a) Water flows in a tapered pipe as shown in Figure 3.Determine the magnitude of deflection " h" of differential mercury manometer corresponding to a discharge of 0.150 m^3/s .The friction in the pipe may be neglected and specific gravity of mercury is 13.6. (7)

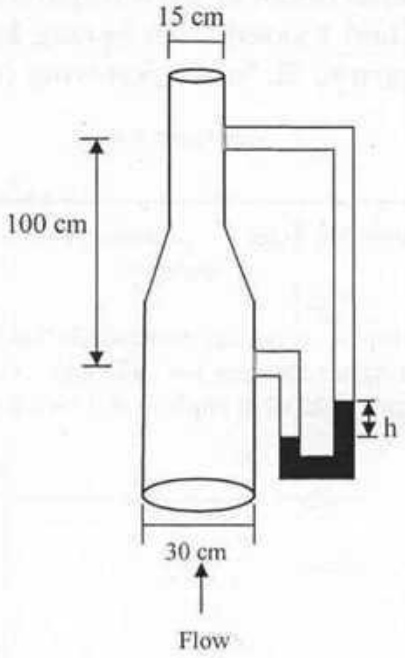


Figure 3

(b) A right-angled triangular weir is used to measure the discharge in an open channel .If the depth of water is 15 cm calculate the discharge over the weir. Assume $C_d = 0.62$. (2)

(c) Determine the magnitude and direction of the resultant force exerted on the double nozzle as shown in Figure 4. Both nozzle jets have a velocity of 24 m/s. The axis of the pipe and both nozzles lie in a horizontal plane, $\gamma = 9.81$ kN/m^3. Neglect friction. (11)

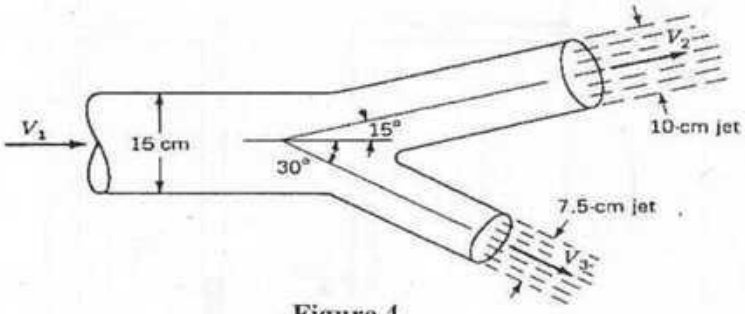


Figure 4

3.(a)The pipes in the system shown in Figure 5 are all made of 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)

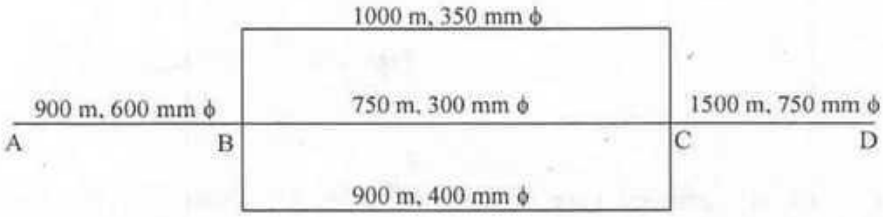


Figure 5

(b). Define Reynolds Number . A ship of 60 m length is to be tested by a model 1.5 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 4.5 N, what prototype drag is to be expected? (1+4=5)

4.(a)Water flows into and out of a two-loop pipe system 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)

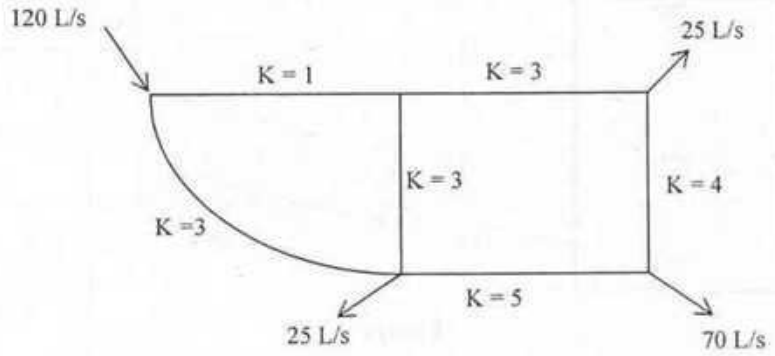


Figure 6

(b) Calculate the Kinetic Energy Correction factor for the following velocity distribution in a circular pipe of radius r_o (10)

$$\frac{u}{u_m} - \left[1 - \left(\frac{r}{r_o}\right)^2\right]$$

5.(a) A nozzle at the end of a pipe (Figure 7) discharges oil (S = 0.8) from a tank to atmosphere. Estimate the discharge from the nozzle when the head H in the tank is 4.0 m. The loss in the pipe can be taken as $20V_1^2/2g$, where V_1 = velocity in the pipe. The loss of energy in the nozzle can be assumed to be $0.11V_2^2/2g$, where V_2 = velocity in the nozzle. Also determine the pressure at the base of the nozzle. (13)

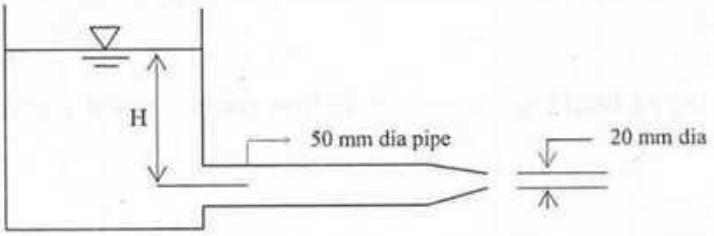


Figure 7

(b). The diameter of a tube is 0.3 m as shown in Figure 8. Determine the velocity of water leaving at C as free jet .Also determine the pressures of water in the tube at B and A. Given , specific weight of water is 9.81 KN/m^3 (7)

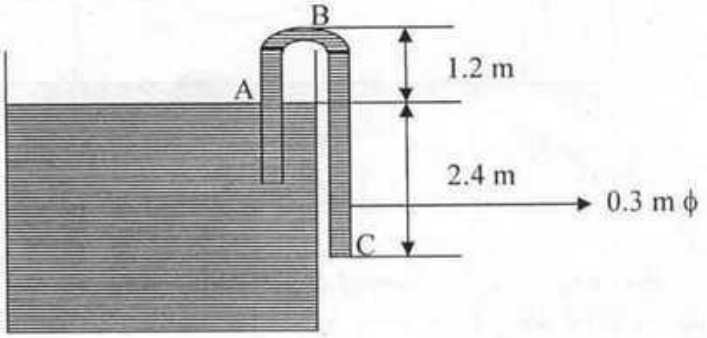


Figure 8

6.(a) Two reservoirs with a difference in water surface elevation of 8 m are connected by a pipeline which consists of two pipes 1 and 2 joined in series as shown in Figure 9. Pipe 1 is 10 cm in diameter, 18 m long and has a value of friction factor f = 0.02. Pipe 2 is of 20 cm diameter, 26 m long and has an f = 0.018. The junctions with the reservoirs and between the pipes are abrupt. Include all the minor losses. Calculate discharge. (8)

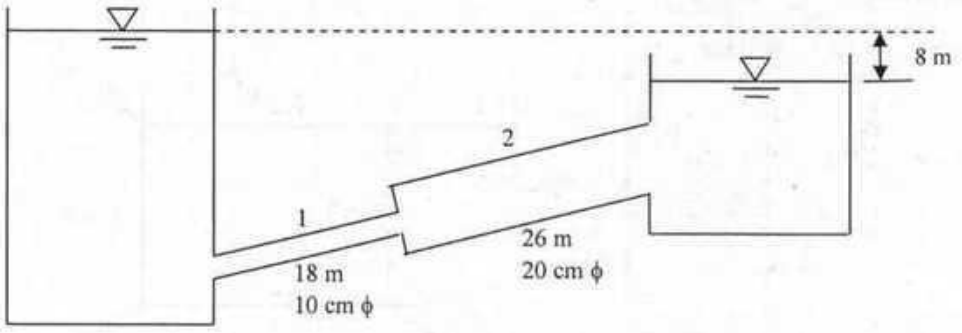


Figure 9

(b) Flow occurs over a spillway of constant section as shown in Figure 10 .Determine the horizontal force on the spillway per foot of spillway width.

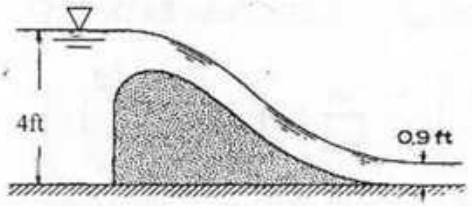


Figure 10

(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 $C_v = 0.90$. (5)

7.(a) Assuming no head loss, determine the flow rate of the sluice gate as shown in Figure 11. (6)

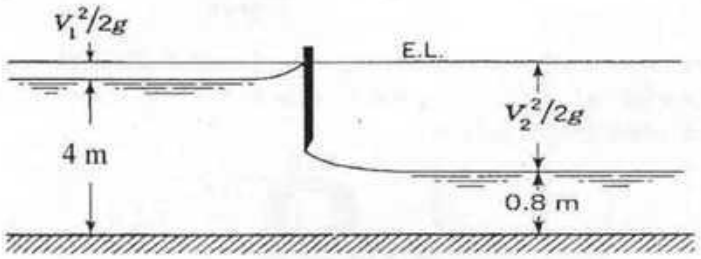


Figure 11

(b) What is a venturimeter? Derive an expression for theoretical discharge through a venturimeter. (6)

(c) 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 Rayleigh Method. (8)

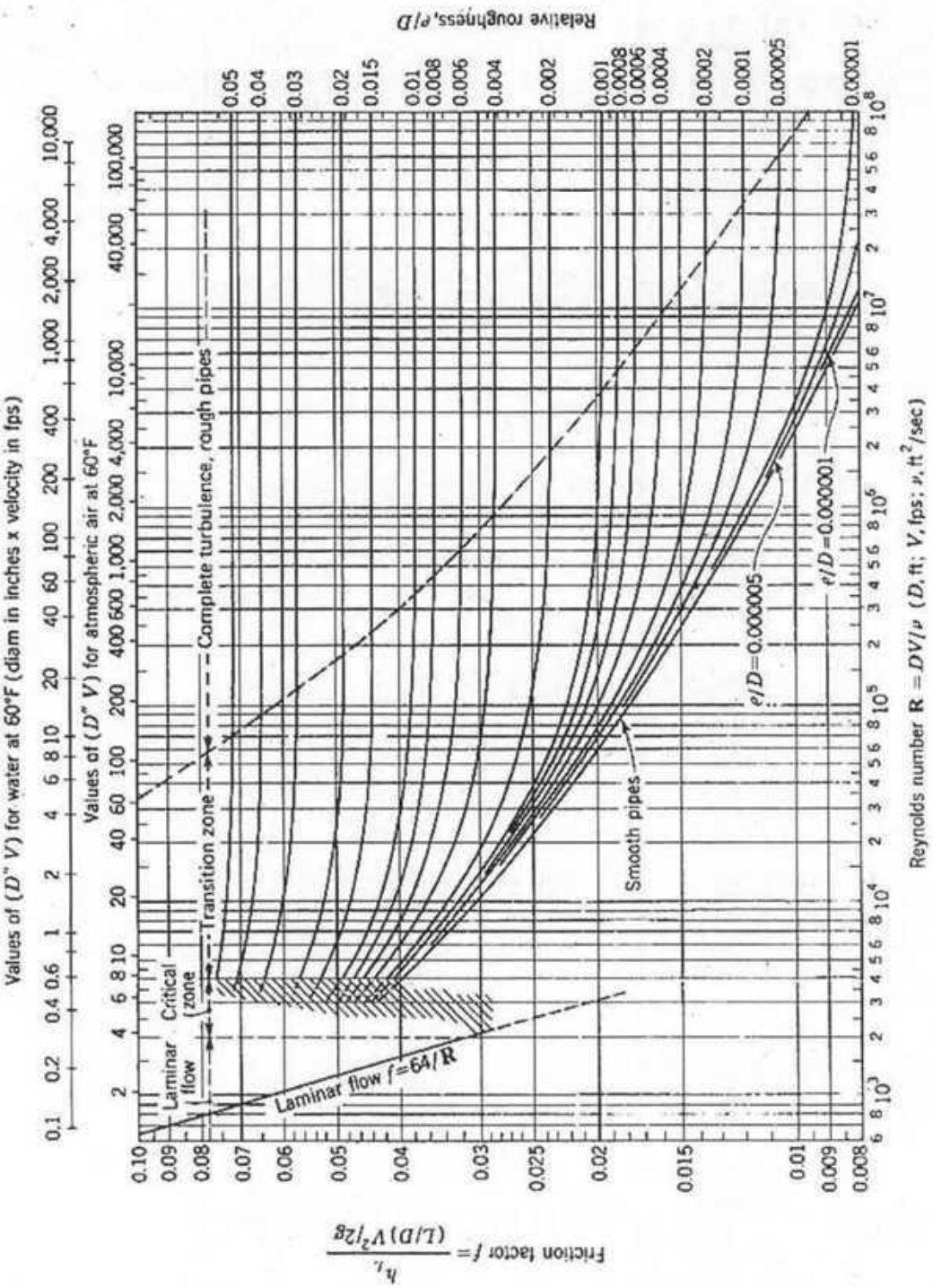


Figure: friction factor for pipes (Moody Diagram)

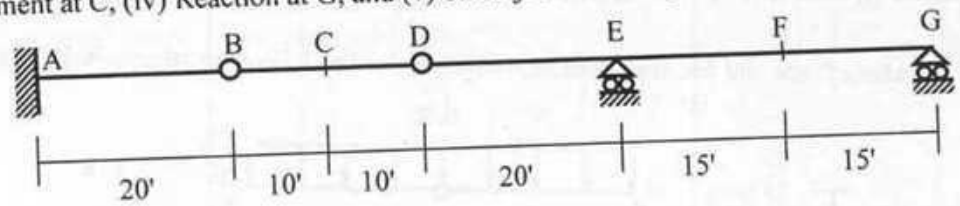
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc Engineering (Civil)

Course Title: Structural Analysis I
Time: 3.00 Hours

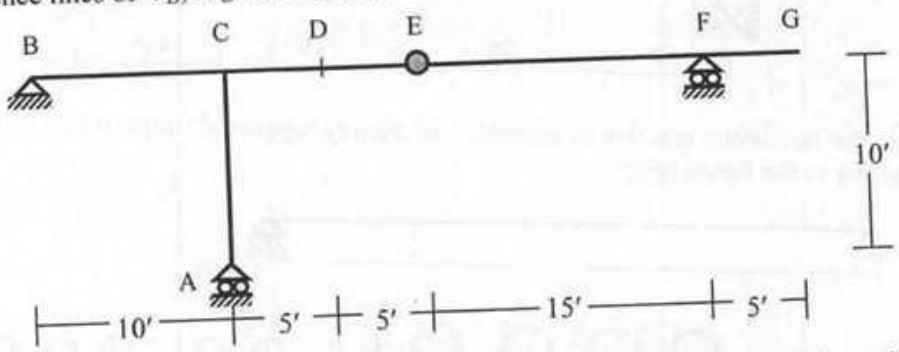
Course Code: CE 311
Full Marks: 100 (=10×10)

*There are **fourteen (14)** questions. Answer any **ten (10)**.*
Assume any missing data reasonably.

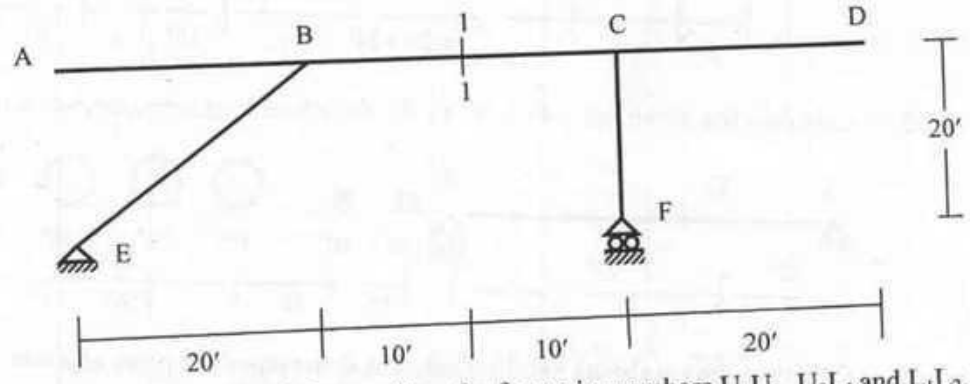
1. For the beam shown below, draw Influence lines for (i) Vertical reaction at A, (ii) Shear at C, (iii) Moment at C, (iv) Reaction at G, and (v) Shear just left of E [B and D are internal hinges].



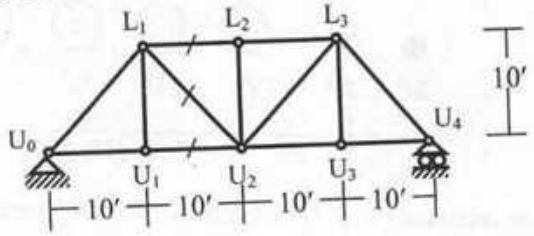
2. Determine the degree of statical indeterminacy (DOSI) of the frame shown below, and draw the influence lines of V_D, M_D and R_B, if the unit load moves over beam BG [E is an internal hinge].



3. Draw the influence Lines of V_1, M_1 and R_F for the frame shown below if the unit load moves over beam AD.

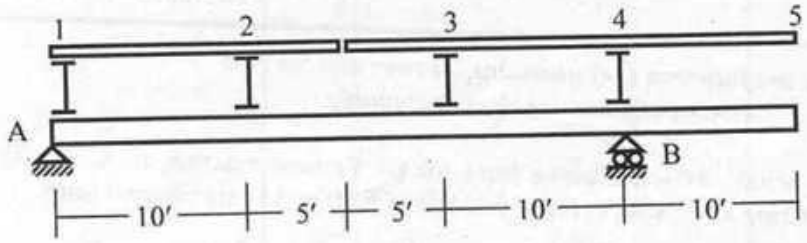


4. For the truss shown below, draw the influence lines for forces in members U_1U_2, U_2L_1 and L_1L_2. Note: There are floor-beams over the bottom-cords.

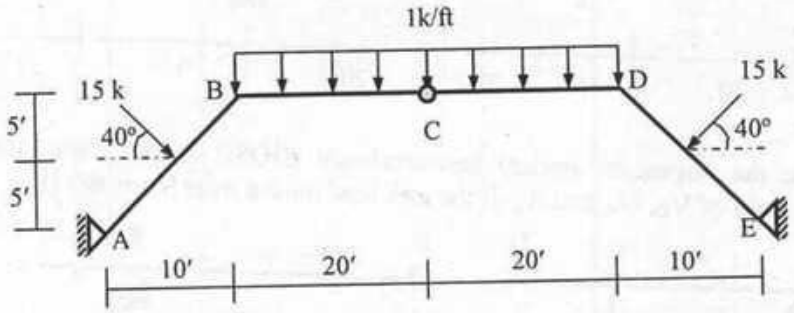


5. Girder AB supports a floor system as shown in the figure below. Draw the Influence lines for

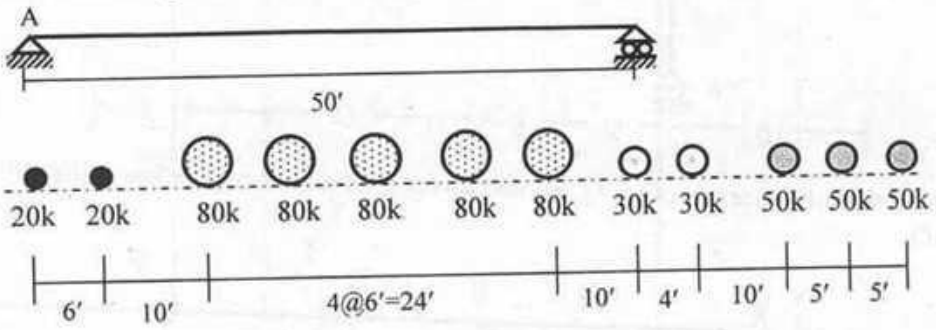
(i) Floor beam reaction at panel point "2"
(ii) Support reaction at "B"
(iii) Shear in panel 2-3 and
(iv) Bending moment for girder at panel point "3".



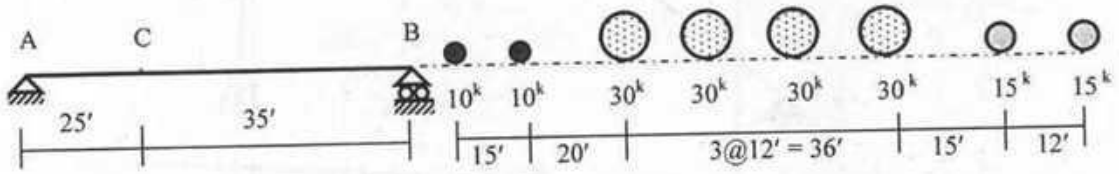
6. Draw the shear force and bending moment diagrams for the following structure. [C is an internal hinge]



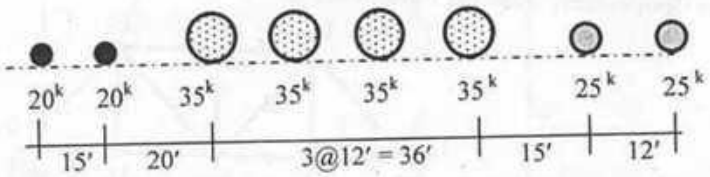
7. Calculate the maximum reaction at support A of simply supported beam of span 50 ft due to the wheel loads shown in the figure below



8. Calculate the maximum value of V_C for the wheel load arrangement shown below.

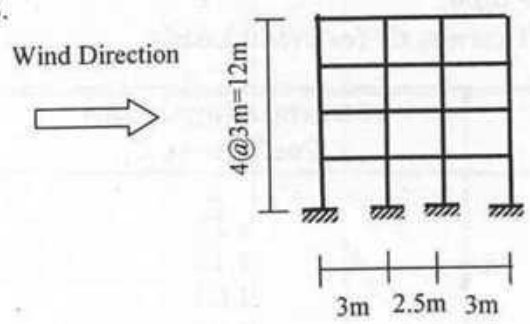


9. Calculate the maximum bending moment at the one-third point of a simply supported beam of span 60 ft due to the wheel loads shown in the figure below.

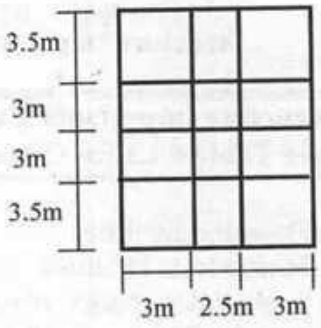


10. Develop the criterion (with net sketch) for which greatest maximum moment in a beam will occur under any wheel load.

11. Calculate the wind load at each story of a four-storied hospital building (shown below) located at a flat terrain in Chittagong (Basic wind speed = 260 km/hr). Assume the structure to be subjected to Exposure B.

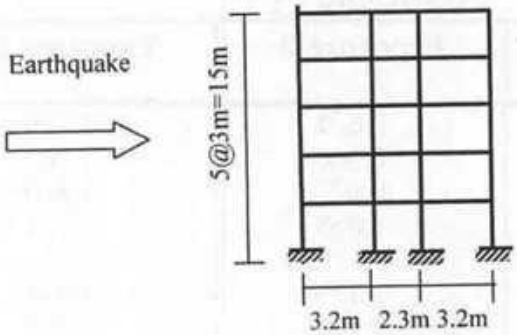


Side Elevation

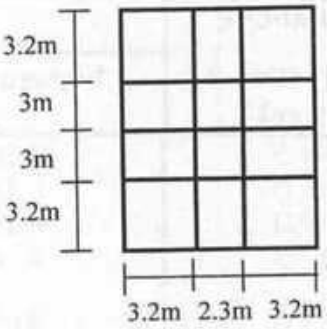


Building Plan

12. Calculate the seismic load at each story of a five-storied hospital building (RCC) shown below located in Dhaka (Zone 2). Assume the structure to be a Special Moment Resisting Frame (SMRF) built on soil condition S_3, carrying a Dead Load of 12 kN/m^2 (including partition load).



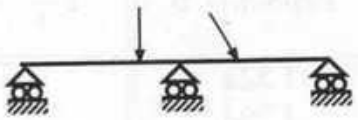
Side Elevation



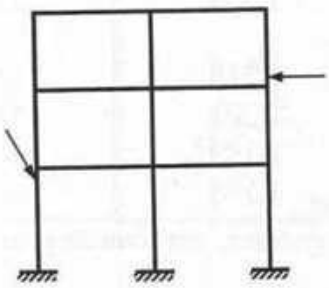
Building Plan

13. a) Derive the "general cable theorem".
b) With the help of General Cable Theorem, derive an expression defining the shape of a cable subjected to uniformly distributed load with respect to horizontal axis with origin at left end of a cable.
c) Hence derive an expression for maximum cable tension under uniform load.

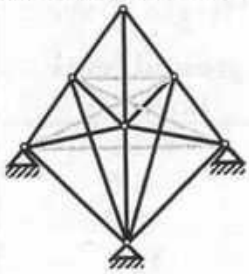
14. a) When is a structure classified as geometrically unstable?
b) Classify each of the structures shown below as statically determinate or statically indeterminate, stable or unstable. If statically indeterminate, determine the number of degrees of indeterminacy.



(i)



(iii)



[3D Truss]

(ii)

Table 6.2.9
Structure Importance Coefficients, C_I for Wind Loads

Structure Importance Category (see Table 6.1.1 for Occupancy)	Structure Importance Coefficient, C_I
I Essential facilities	1.25
II Hazardous facilities	1.25
III Special occupancy structures	1.00
IV Standard occupancy structures	1.00
V Low-risk structures	0.80

Table 6.2.10
Combined Height and Exposure Coefficient, C_z

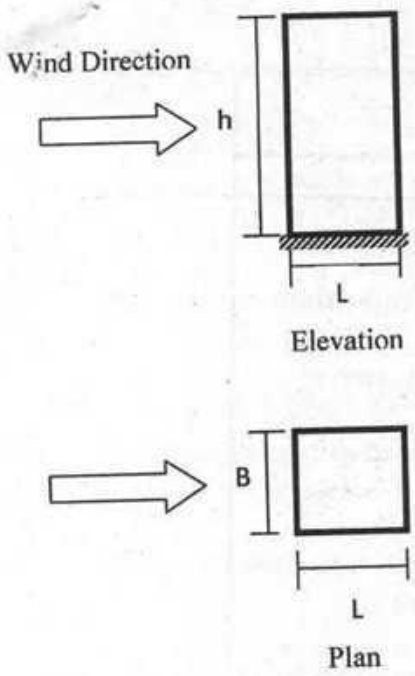
Height above ground level, z (metres)	Coefficient, C_z (1)		
	Exposure A	Exposure B	Exposure C
0-4.5	0.368	0.801	1.196
6.0	0.415	0.866	1.263
9.0	0.497	0.972	1.370
12.0	0.565	1.055	1.451
15.0	0.624	1.125	1.517
18.0	0.677	1.185	1.573
21.0	0.725	1.238	1.623
24.0	0.769	1.286	1.667

Note : (1) Linear interpolation is acceptable for intermediate values of z.

Table 6.2.11
Gust Response Factors, G_h and G_z (1)

Height above ground level (metres)	G_h (2) and G_z		
	Exposure A	Exposure B	Exposure C
0-4.5	1.654	1.321	1.154
6.0	1.592	1.294	1.140
9.0	1.511	1.258	1.121
12.0	1.457	1.233	1.107
15.0	1.418	1.215	1.097
18.0	1.388	1.201	1.089
21.0	1.363	1.189	1.082
24.0	1.342	1.178	1.077

Note : (1) For main wind-force resisting systems, use building or structure height h for z.
(2) Linear interpolation is acceptable for intermediate values of z.



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

Note:(1) These coefficients are to be used with Method-2 given in Sec 2.4.6.6a(ii). Use $\bar{C}_p = \pm 0.7$ for roof in all cases.

(2) Linear interpolation may be made for intermediate values of $\bar{h}/B$ and L/B.

Earthquake Load Calculation

Table 6.2.23
Structure Importance Coefficients *I*, *I'*

Structure Importance Category (see Table 6.1.1 for occupancy)	Structure Importance Coefficient	
	I	*I'*
I Essential facilities	1.25	1.50
II Hazardous facilities	1.25	1.50
III Special occupancy structures	1.00	1.00
IV Standard occupancy structures	1.00	1.00
V Low-risk Structures	1.00	1.00

Table 6.2.24
Response Modification Coefficient for Structural Systems, *R*

Basic Structural System(1)	Description of Lateral Force Resisting System	*R* (2)
c. Moment Resisting Frame System	1. Special moment resisting frames (SMRF)	
	i) Steel	12
	ii) Concrete	12
	2. Intermediate moment resisting frames (IMRF), concrete(4)	8
	3. Ordinary moment resisting frames (OMRF)	
	i) Steel	6
	ii) Concrete (5)	5

Table 6.2.25

Site Coefficient, S for Seismic Lateral Forces (1)

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

Note : (1) The site coefficient shall be established from properly substantiated geotechnical data. In locations where the soil properties are not known in sufficient detail to determine the soil profile type, soil profile S_3 shall be used. Soil profile S_4 need not be assumed unless the building official determines that soil profile S_4 may be present at the site, or in the event that soil profile S_4 is established by geotechnical data.

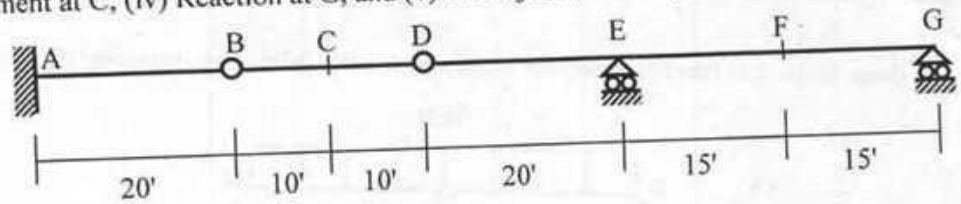
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc Engineering (Civil)

Course Title: Structural Analysis I
Time: 3.00 Hours

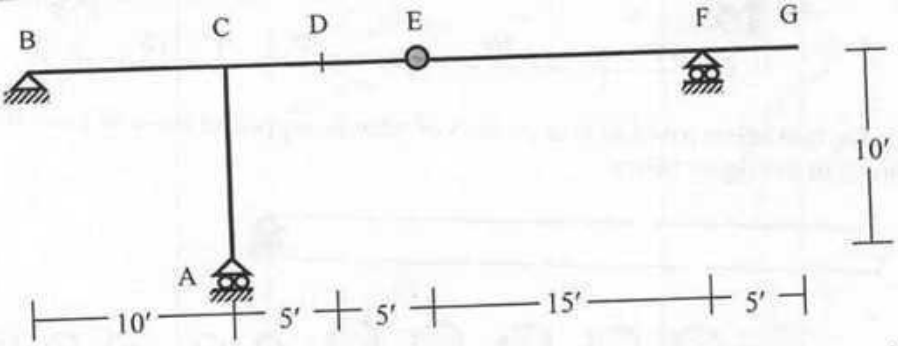
Course Code: CE 311
Full Marks: 100 (=10×10)

*There are **fourteen (14)** questions. Answer any **ten (10)**.*
Assume any missing data reasonably.

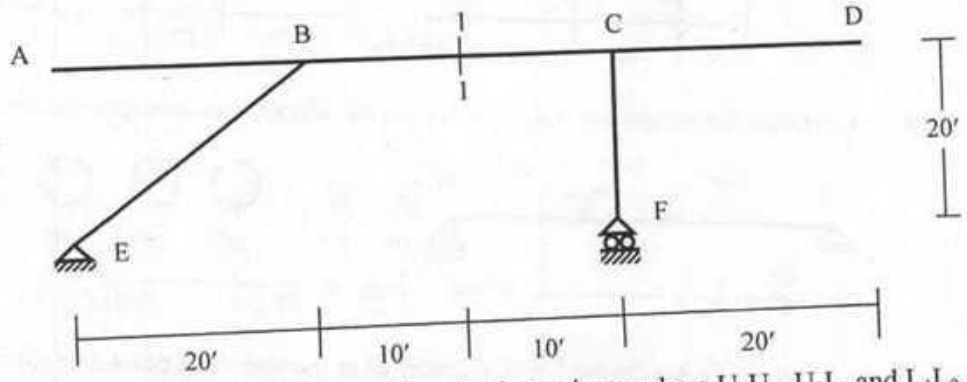
1. For the beam shown below, draw Influence lines for (i) Vertical reaction at A, (ii) Shear at C, (iii) Moment at C, (iv) Reaction at G, and (v) Shear just left of E [B and D are internal hinges].



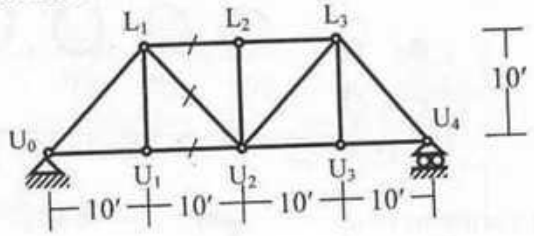
2. Determine the degree of statical indeterminacy (DOSI) of the frame shown below, and draw the influence lines of V_D, M_D and R_B, if the unit load moves over beam BG [E is an internal hinge].



3. Draw the influence Lines of V_1, M_1 and R_F for the frame shown below if the unit load moves over beam AD.

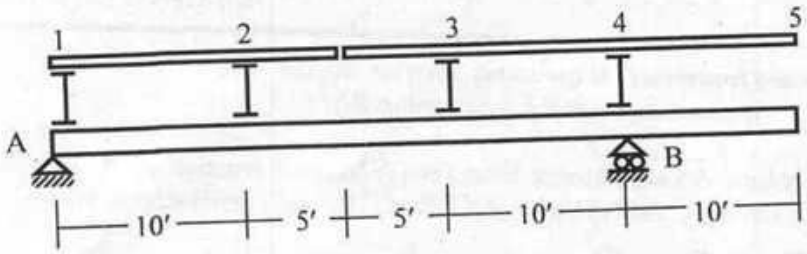


4. For the truss shown below, draw the influence lines for forces in members U_1U_2, U_2L_1 and L_1L_2. Note: There are floor-beams over the bottom-cords.

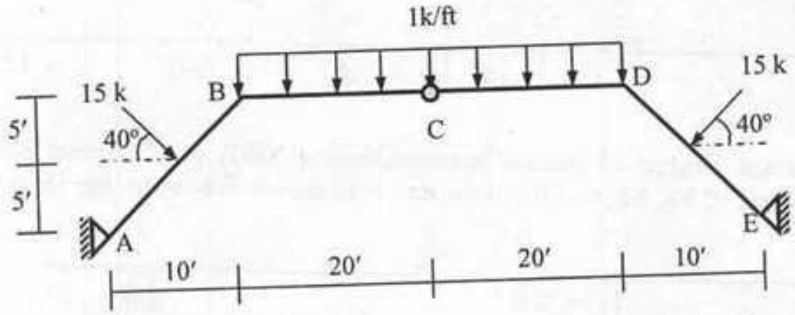


5. Girder AB supports a floor system as shown in the figure below. Draw the Influence lines for

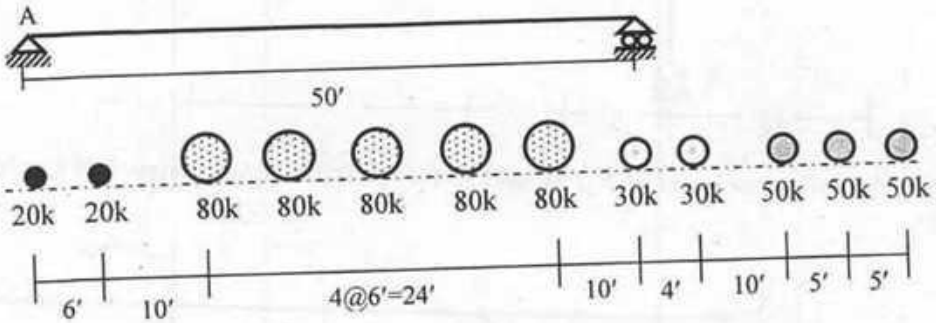
(i) Floor beam reaction at panel point "2"
(ii) Support reaction at "B"
(iii) Shear in panel 2-3 and
(iv) Bending moment for girder at panel point "3".



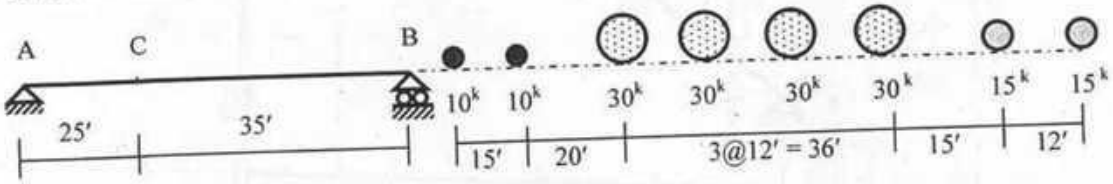
6. Draw the shear force and bending moment diagrams for the following structure. [C is an internal hinge]



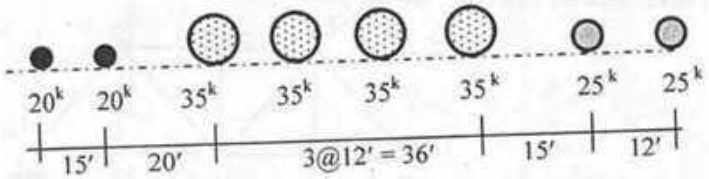
7. Calculate the maximum reaction at support A of simply supported beam of span 50 ft due to the wheel loads shown in the figure below



8. Calculate the maximum value of V_C for the wheel load arrangement shown below.

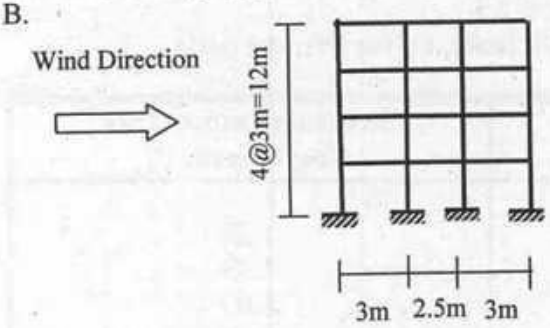


9. Calculate the maximum bending moment at the one-third point of a simply supported beam of span 60 ft due to the wheel loads shown in the figure below.

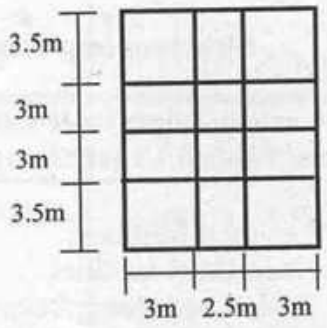


10. Develop the criterion (with net sketch) for which greatest maximum moment in a beam will occur under any wheel load.

11. Calculate the wind load at each story of a four-storied hospital building (shown below) located at a flat terrain in Chittagong (Basic wind speed = 260 km/hr). Assume the structure to be subjected to Exposure B.

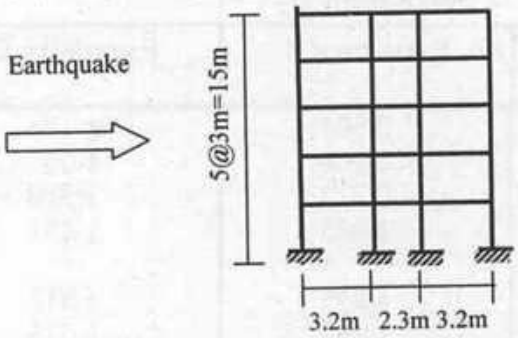


Side Elevation

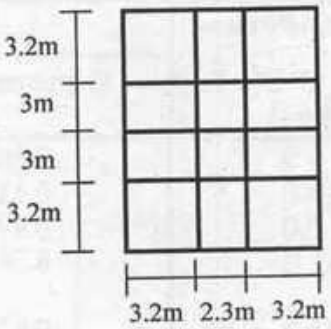


Building Plan

12. Calculate the seismic load at each story of a five-storied hospital building (RCC) shown below located in Dhaka (Zone 2). Assume the structure to be a Special Moment Resisting Frame (SMRF) built on soil condition S_3, carrying a Dead Load of 12 kN/m^2 (including partition load).



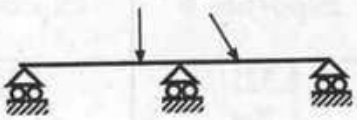
Side Elevation



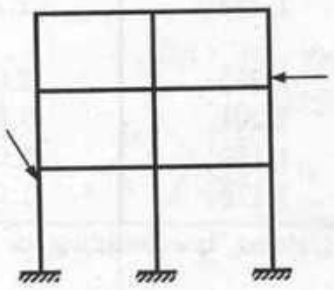
Building Plan

13. a) Derive the "general cable theorem".
b) With the help of General Cable Theorem, derive an expression defining the shape of a cable subjected to uniformly distributed load with respect to horizontal axis with origin at left end of a cable.
c) Hence derive an expression for maximum cable tension under uniform load.

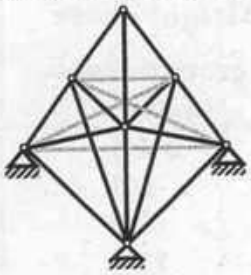
14. a) When is a structure classified as geometrically unstable?
b) Classify each of the structures shown below as statically determinate or statically indeterminate, stable or unstable. If statically indeterminate, determine the number of degrees of indeterminacy.



(i)



(iii)



[3D Truss]

(ii)

Table 6.2.9
Structure Importance Coefficients, C_I for Wind Loads

Structure Importance Category (see Table 6.1.1 for Occupancy)	Structure Importance Coefficient, C_I
I Essential facilities	1.25
II Hazardous facilities	1.25
III Special occupancy structures	1.00
IV Standard occupancy structures	1.00
V Low-risk structures	0.80

Table 6.2.10
Combined Height and Exposure Coefficient, C_z

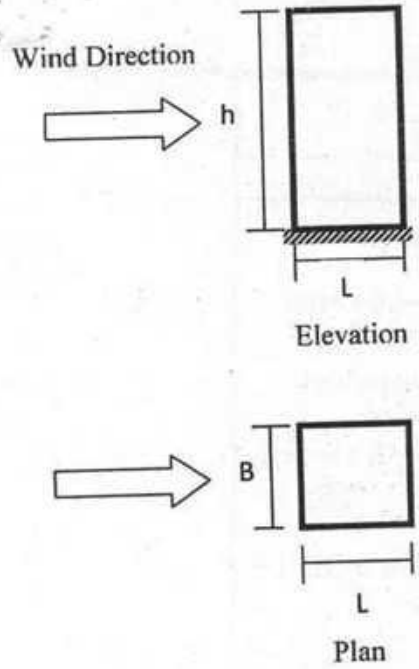
Height above ground level, z (metres)	Coefficient, C_z (1)		
	Exposure A	Exposure B	Exposure C
0-4.5	0.368	0.801	1.196
6.0	0.415	0.866	1.263
9.0	0.497	0.972	1.370
12.0	0.565	1.055	1.451
15.0	0.624	1.125	1.517
18.0	0.677	1.185	1.573
21.0	0.725	1.238	1.623
24.0	0.769	1.286	1.667

Note : (1) Linear interpolation is acceptable for intermediate values of z.

Table 6.2.11
Gust Response Factors, G_h and G_z (1)

Height above ground level (metres)	G_h (2) and G_z		
	Exposure A	Exposure B	Exposure C
0-4.5	1.654	1.321	1.154
6.0	1.592	1.294	1.140
9.0	1.511	1.258	1.121
12.0	1.457	1.233	1.107
15.0	1.418	1.215	1.097
18.0	1.388	1.201	1.089
21.0	1.363	1.189	1.082
24.0	1.342	1.178	1.077

Note : (1) For main wind-force resisting systems, use building or structure height h for z.
(2) Linear interpolation is acceptable for intermediate values of z.



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	2.30	2.80	2.20	1.60	1.25

Note:(1) These coefficients are to be used with Method-2 given in Sec 2.4.6.6a(ii). Use $\bar{C}_p = \pm 0.7$ for roof in all cases.

(2) Linear interpolation may be made for intermediate values of h/B and L/B.

Earthquake Load Calculation

Table 6.2.23
Structure Importance Coefficients I, I'

Structure Importance Category (see Table 6.1.1 for occupancy)	Structure Importance Coefficient	
	I	I'
I Essential facilities	1.25	1.50
II Hazardous facilities	1.25	1.50
III Special occupancy structures	1.00	1.00
IV Standard occupancy structures	1.00	1.00
V Low-risk Structures	1.00	1.00

Table 6.2.24
Response Modification Coefficient for Structural Systems, R

Basic Structural System(1)	Description of Lateral Force Resisting System	R (2)
c. Moment Resisting Frame System	1. Special moment resisting frames (SMRF)	
	i) Steel	12
	ii) Concrete	12
	2. Intermediate moment resisting frames (IMRF), concrete(4)	8
	3. Ordinary moment resisting frames (OMRF)	
	i) Steel	6
	ii) Concrete (5)	5

Table 6.2.25

Site Coefficient, S for Seismic Lateral Forces (1)

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

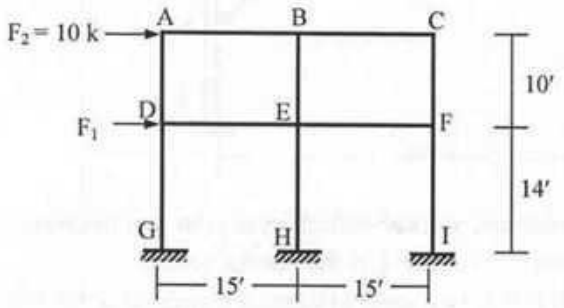
Note : (1) The site coefficient shall be established from properly substantiated geotechnical data. In locations where the soil properties are not known in sufficient detail to determine the soil profile type, soil profile S_3 shall be used. Soil profile S_4 need not be assumed unless the building official determines that soil profile S_4 may be present at the site, or in the event that soil profile S_4 is established by geotechnical data.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

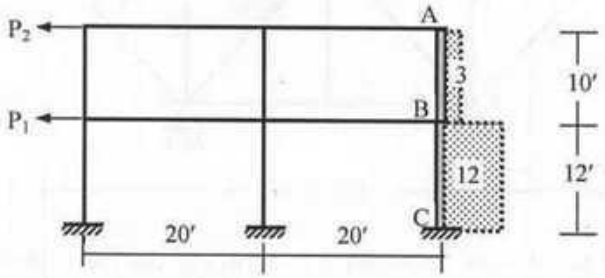
Course Title: Structural Engineering II | Credit Hours: 3.0 | Course Code: CE 313
Time: 3 hours | Full Marks: 100 (=10 × 10)

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

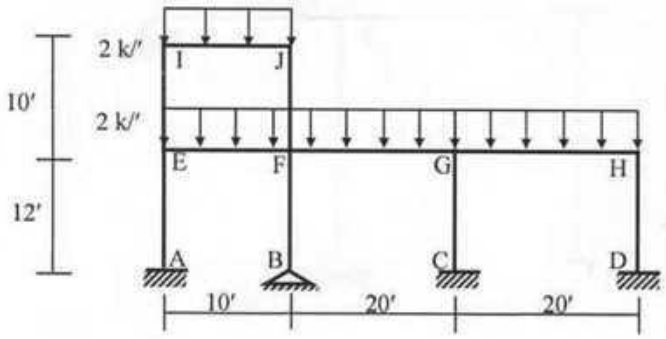
1. For the structure shown below, use the Portal Method to
   (i) Draw the bending moment diagrams of the top floor beams AB and BC
   (ii) Calculate the applied load F_1 if the maximum bending moment in column EH is 30 k-ft.



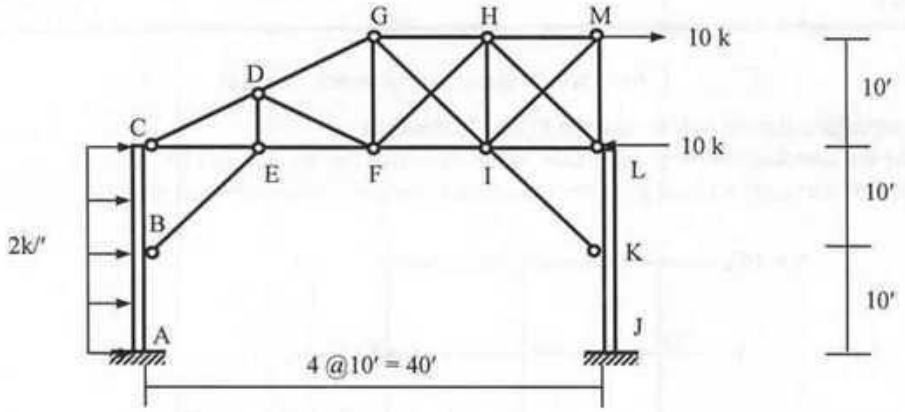
2. The figure below shows the axial forces (kips) in the exterior columns of a two-storied frame. If the cross-sectional area of column ABC is twice the area of the other columns, use the Cantilever Method to calculate the corresponding applied loads P_1 and P_2.



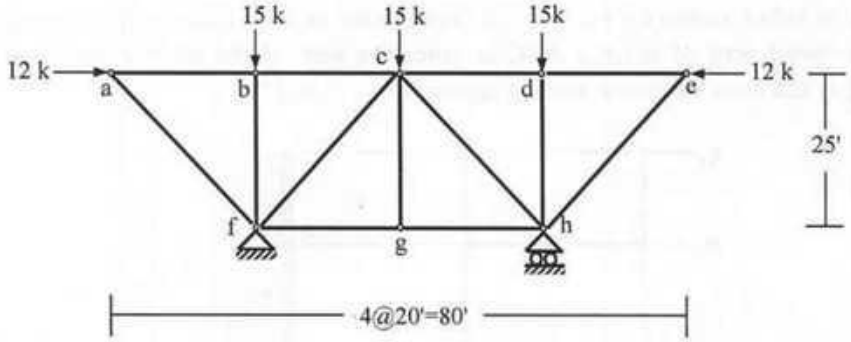
3. Analyze the two-storied frame structure loaded as shown below using the approximate location of hinges to draw the bending moment diagrams of the beams and columns.



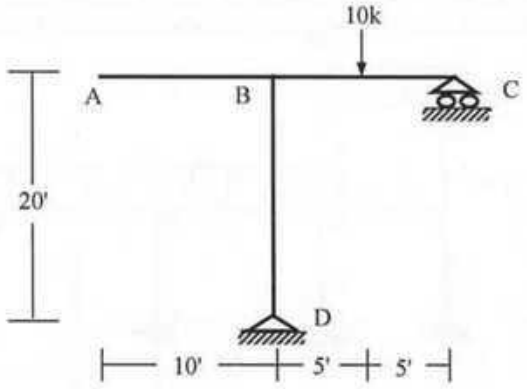
4. In the mill bent shown below
   (i) Use the Portal Method to draw the bending moment diagram of the column ABC.
   (ii) Calculate the forces in GI and FH, assuming them to take equal share of the sectional shear.



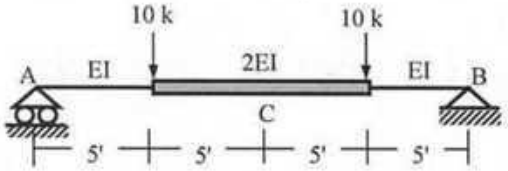
5. Use Unit Load Method to calculate the vertical deflection at joint c of the truss shown below due to (i) Applied loads, (ii) Temperature drop of 20° F in the bottom cords
   [Given: EA/L = constant = 1000 k/ft, Co-efficient of thermal expansion $\alpha = 5.5 \times 10^{-6}$/°F].



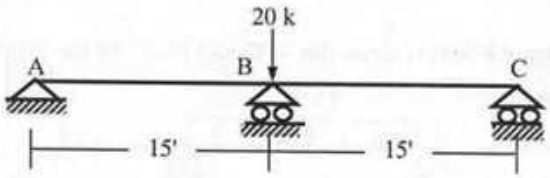
6. Use Unit Load Method to calculate the rotation at A (θ_A) of the frame shown below, considering axial, shear and flexural deformations [Given: EA = 400×10^3 k, GA* = 125×10^3 k, EI = 40×10^3 k-ft^2].



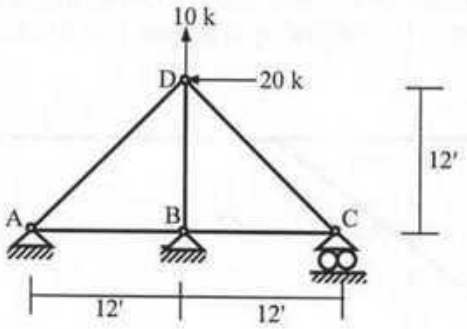
7. Use the Virtual Work Method (considering flexural deformation only) to calculate the vertical deflection at point C of the beam shown below [Given EI = 40,000k-ft^2].



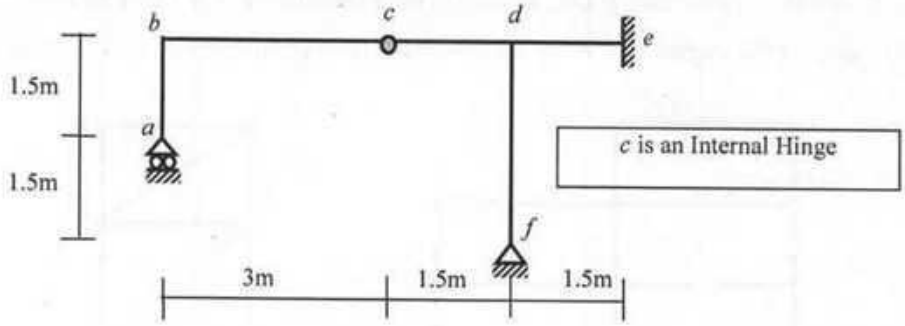
8. Use the Flexibility Method to draw the BMD of the beam shown below, if in addition to the applied load, support C settles down 0.10' [Given: EI = 40×10^3 k-ft^2].



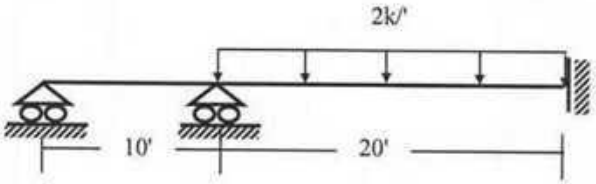
9. Use the Flexibility Method to calculate the bar forces of the truss shown below, if in addition to the applied loads, support C settles down 0.10' [Given: EA/L = 1000 k/ft].



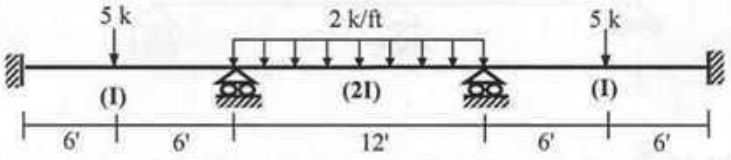
10. Use the Flexibility Method (considering flexural deformations only) to draw the bending moment diagram of the frame shown below, if support *f* settles 15-mm downward [Given: EI = constant = 20 MN-m^2].



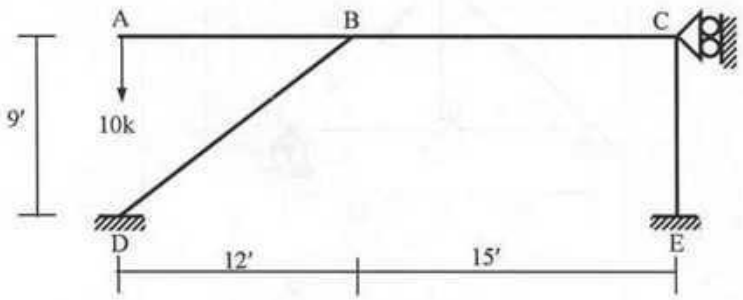
11. Draw the BMD of the following beam using the Moment Distribution Method [Given: EI = constant].



12. Use the Moment Distribution method to draw the SFD and BMD of the following beam.



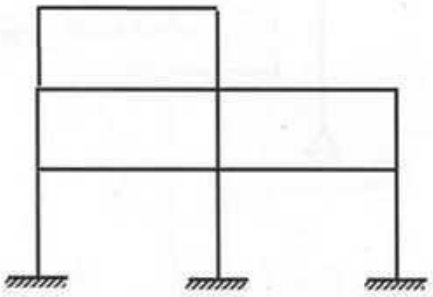
13. Use the Moment Distribution method to draw the BMD of the following frame if in addition to the applied load, support E settles 0.05′ downwards [Given, EI = 40,000 k-ft^2].



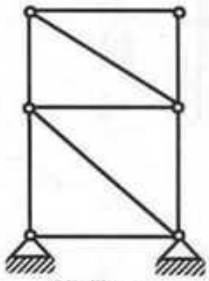
14. (i) Write down the basic difference between Lateral Load Analysis by Portal and Cantilever Method.

    (ii) Comment on two basic characteristics of the Flexibility Matrix of a structure.

    (iii) Calculate the degree of statical indeterminacy (dosi) of the structures shown below.



2D Frame



2D Truss

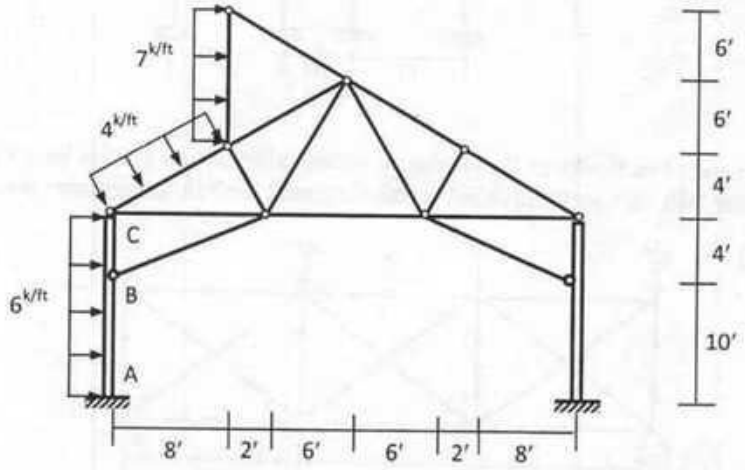
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

Course Title : Structural Engineering II
Time : 3 hours

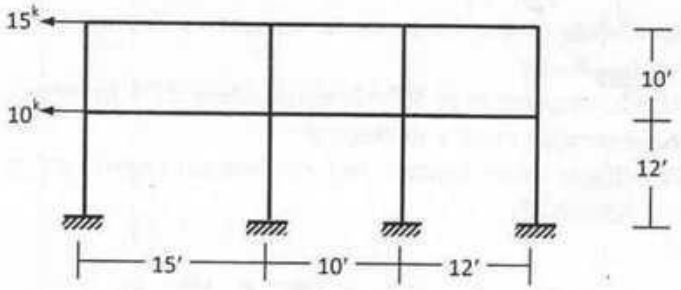
Course Code: CE 313
Full Marks : 100

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

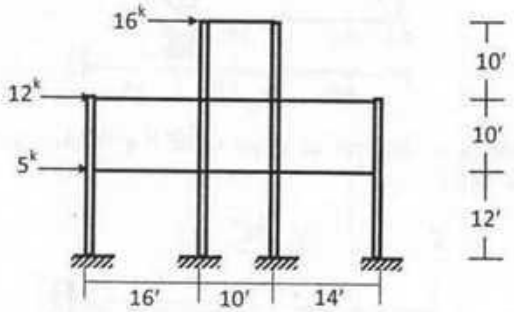
1. In the bridge portal shown below, use the Portal Method to draw the SFD and BMD of the column ABC.



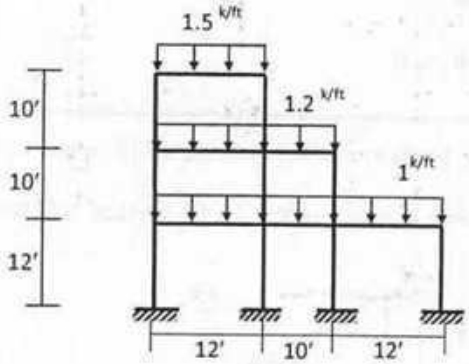
2. For the 2-storied frame loaded as shown, use the Portal Method to draw the SFD and BMD of the columns and the beams.



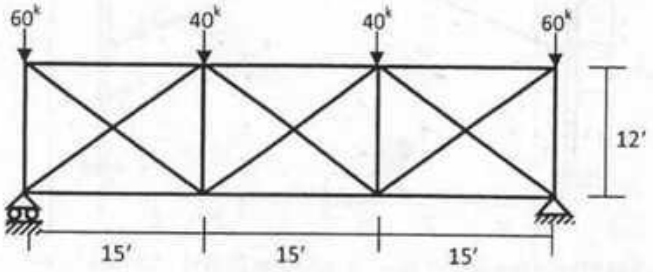
3. For the structure shown below, use the Cantilever Method to draw the AFD of the columns, SFD and BMD of the beams. Assume all column areas are equal.



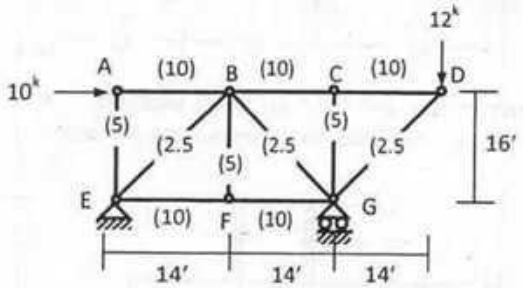
4. For the 2-storied frame structure loaded as shown below, use the approximate location of hinges to draw the SFD and BMD of the beams and columns.



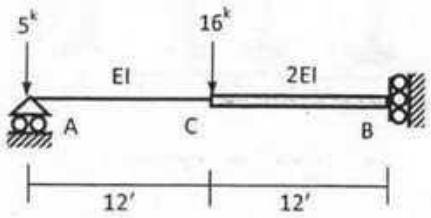
5. Calculate member forces of the statically indeterminate truss shown below assuming that full panel shear will be equally divided by the diagonals both in tension and compression.



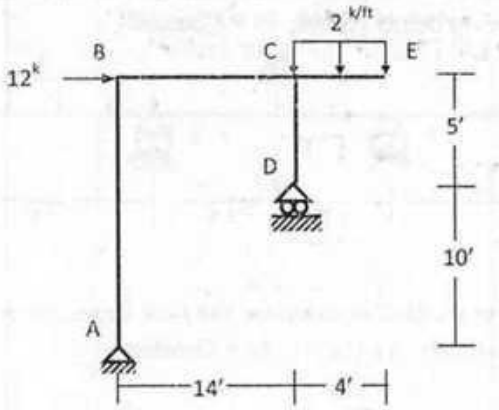
6. Use virtual work method to determine the horizontal deflection of A for
   (i) Applied load
   (ii) Rise in temperature of 50°F in top members, 25°F in bottom chord members and fall in temperature of 25°F in diagonals.
   Parenthesis values indicate area of members in square inches [Given, E= 30X10^3 ksi, α_t=1/150000/°F]



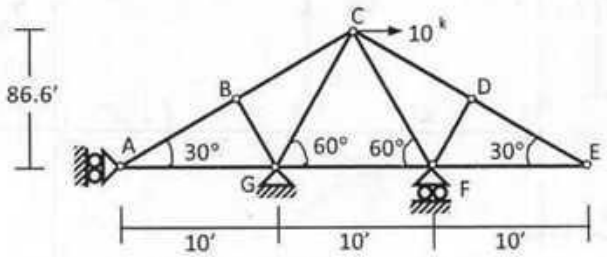
7. Calculate the vertical deflection at point C of the beam shown below using virtual work method [Given EI= 40,000k-ft^2].



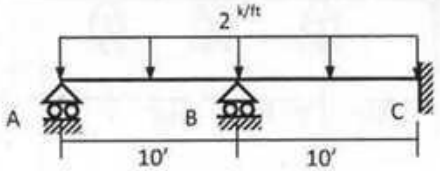
8. Use the virtual work method to calculate the vertical deflection at joint B of the frame shown below [Given, EA = 400×10^3 k, GA* = 125×10^3 k, EI = 40×10^3 k-ft^2]



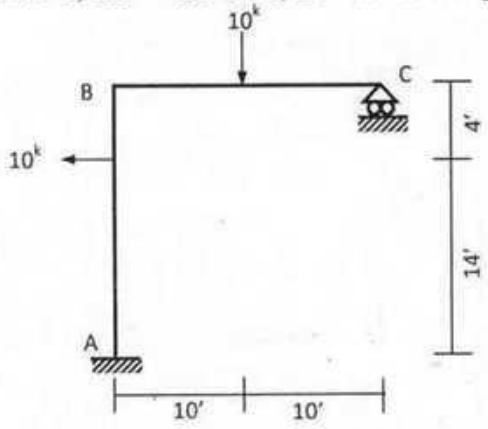
9. Use the flexibility method to calculate the member forces of the truss shown below, if in addition to the applied load, support A moves 0.10' leftward [Given, EA/L= 1000 kips/ft]



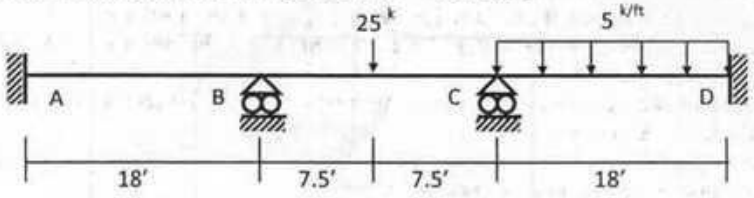
10. Use the flexibility method (considering flexural deformation only) to draw the bending moment diagram of the beam shown below, if in addition to the applied load, support A settles 0.10' downward [Given, EI = 40×10^3 k-ft^2]



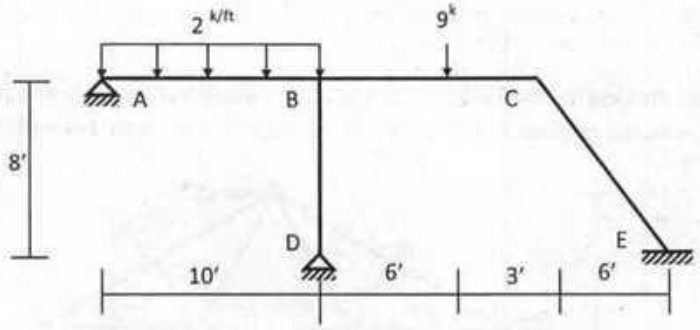
11. Using flexibility method, draw the bending moment diagram of the frame shown below [Given, EA = 400×10^3 k, GA* = 125×10^3 k, EI = 40×10^3 k-ft^2]



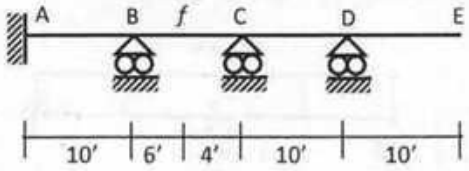
12. Use moment distribution method to calculate the joint moments and draw bending moment diagram of the beam shown below [Given, EI = Constant]



13. Use moment distribution method to calculate the joint moments and draw bending moment diagram of the frame shown below [Given, EI = Constant]



14. For the beam shown below,
    (i) Draw the qualitative influence lines for R_A, $V_{C(L)}$ and M_f.
    (ii) Calculate the maximum positive value of M_f, if the beam is subjected to a uniformly distributed DL = 1.5 k/ft and moving LL = 0.5 k/ft (uniformly distributed) and 3 k (concentrated) [Given, EI = Constant]



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

$M_{(+)} = 0.08\ wL^2$, $M_{(-)} = 0.045\ wL^2$,

$V_{(+)} = 0.50wL$, and $V_{(-)} = -0.50wL$

*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, $\Delta = \Sigma N_1\, dL = \Sigma N_1 (N_0L/EA + \alpha\Delta T\, L + \Delta L)$

*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

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

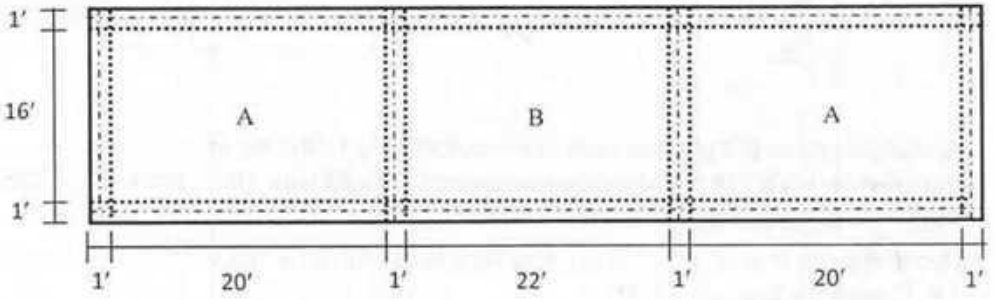
Course Title: Design of Concrete Structures II | Course Code: CE 317
Time: 3hrs | Full Marks: 15X10=150

There are two parts of this question. (Part A and Part B)

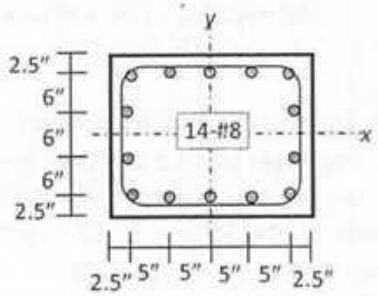
PART A

[There are 10 (ten) questions. Answer any 7 **(seven)**]

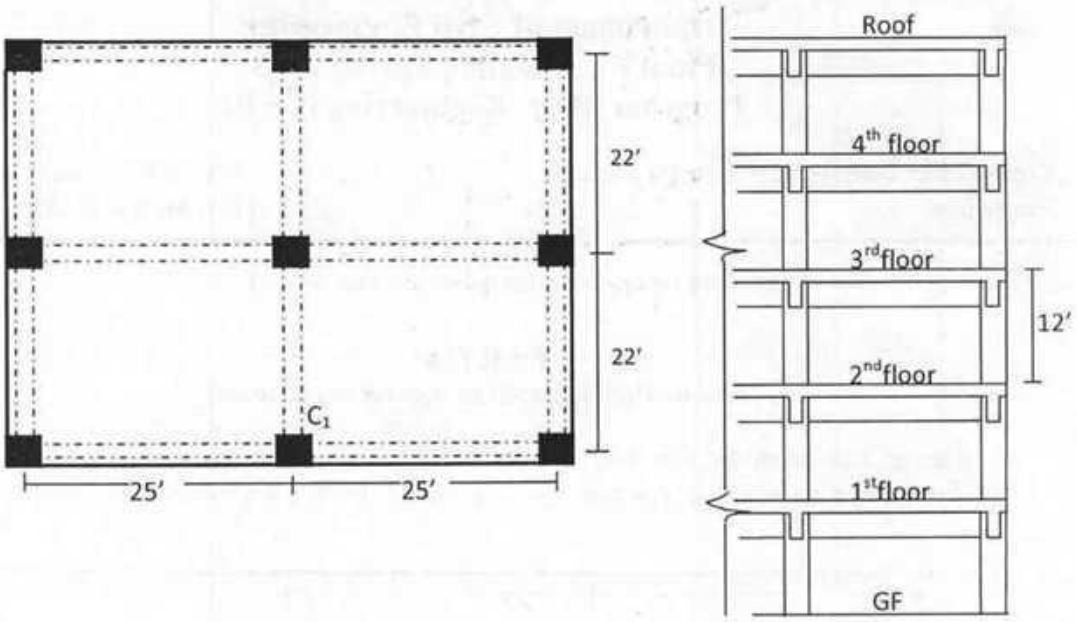
1. Design and detail the two way slab by WSD. [Given, Slab thickness 7", FF = 25 psf, RW=25 psf, LL = 40 psf, f_c'= 3 ksi, f_s = 20 ksi, n = 9, k = 0.378, j = 0.874, R = 223 psi]



2. For the tied column section shown below [with f_c'= 3 ksi, f_y = 60 ksi] , use the WSD to
   i. Draw the interaction diagram about x-axis
   ii. Calculate the allowable moment of the section if it is subjected to axial force
   a. P = 200 k and b. P = 600 k
   iii. Using Bresler's equation, verify if the sectionis allowed to take P = 350 k along with bending moments M_x = 900 k-in and M_y = 1200 k-in.

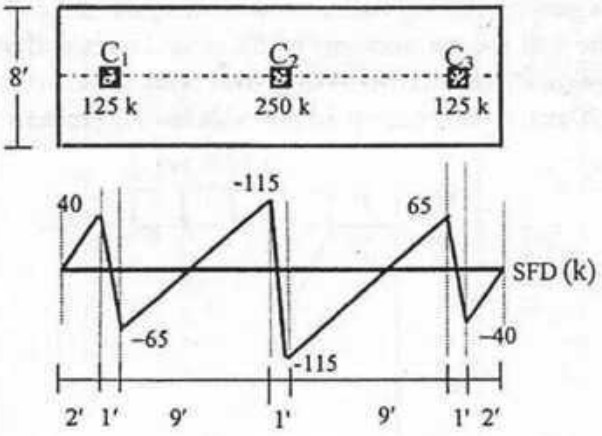


3. Refer to the following figure. Design the column C1 at ground level using USD. Design data: Slab thickness 8", Proposed column size 24"x24", LL on floor slab= 40 psf, LL on roof slab= 20 psf, Random wall= 25 psf, Lime Concrete on roof= 20 psf, Floor Finish= 25 psf, Beam size 12"x24" (including slab), f_c'= 4 ksi, and f_y = 60 ksi.

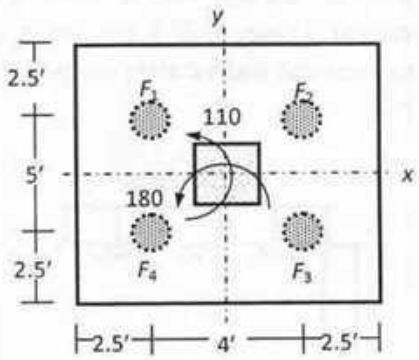


4. An isolated footing is planned under a column with the following data:
Column size = 18"x18 ", Column reinforcements = 8 - #8 bars, DL = 300 k, LL = 220 k, $q_{all.}$= 5 ksf, f_c'= 4 ksi, and f_y = 60 ksi.
Due to the site restriction, the maximum footing dimension in one direction is to be limited at 8 ft. Design the footing by USD.
Follow the steps mentioned below:
   i. Calculation for bearing area (i.e. size of the footing)
   ii. Check for punching shear
   iii. Check for beam shear
   iv. Calculation for design moment and check for footing thickness
   v. Calculation for reinforcements
   vi. Check for flexural bond stress
   vii. Design for dowels
   viii. Neat sketches of reinforcements (plan and sections)

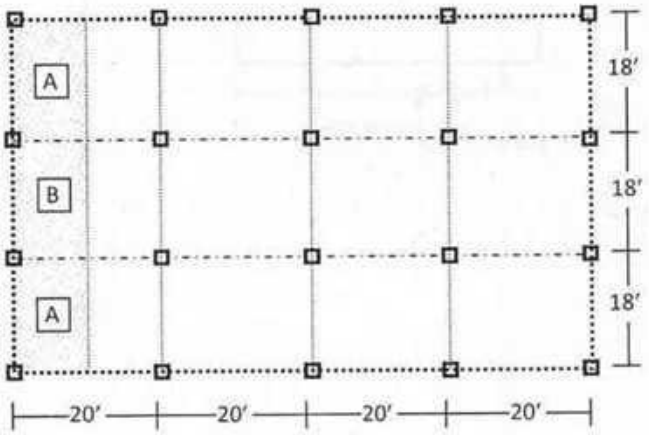
5. The loads (including self-weight) and arrangement of columns of size 12"x12" and the corresponding shear force diagram of the combined footing are shown below. Use WSD to
   i. Draw the bending moment diagram of the footing.
   ii. If the thickness of the footing is 22", check the adequacy of the thickness for punching shear, beam shear and bending.
   iii. Calculate longitudinal reinforcements and show them in neat sketch.



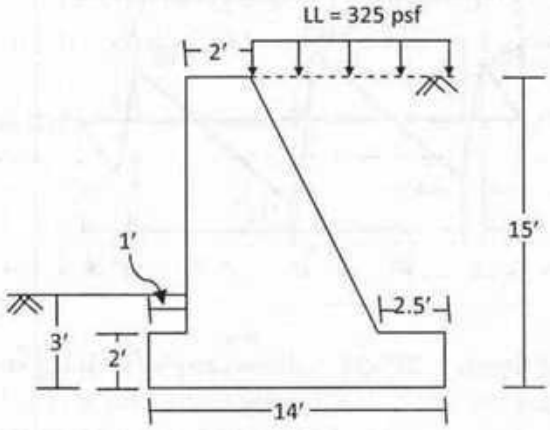
6. Refer to the following figure. A 24"×24" column carrying working loads of DL = 225 k, and LL = 175 k is underlain by soil with allowable bearing capacity = 2 ksf. The column also carries biaxial moments (due to LL) of M_x= 110 k-ft and M_y = 180 k-ft. Design the pile foundation by USD. [Given: f_c'=3 ksi, f_y =50 ksi].



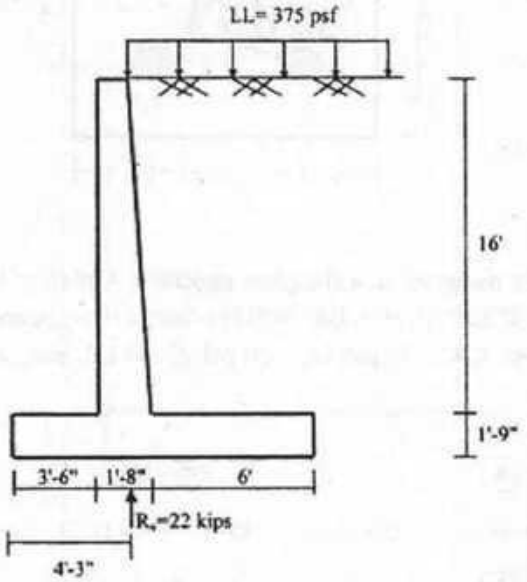
7. A building is to be designed as a flat plate structure. A plan of the building is shown below. The columns are 20"X20" in size. Use WSD to design Panel A and Panel B.
[Given, FF = 25 psf, RW = 30 psf, LL = 50 psf, f_c' = 4 ksi, and f_y = 60 ksi]



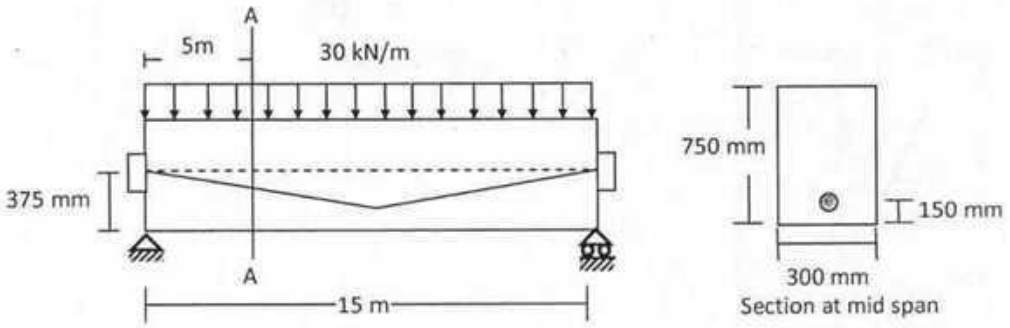
8. A section of a gravity retaining wall as shown in the following figure was made to support the soil behind the wall and the surcharge on the ground surface. Check the external stability of the section against sliding and overturning. Also check the soil pressure under the base. [Given, γ_s= 120 pcf, φ= 30°, f_{base}= 0.5, Allowable bearing pressure= 4 tsf.]



9. A cross section of a cantilever retaining wall is shown in the following figure. If R_v, the vertical component of reaction is equal to 22 k and acts at a distance 4.25 ft from the toe as shown, design the footing (heel slab and toe slab) using WSD. [Given, γ_s= 120 pcf, f_c'= 3 ksi, f_s = 24 ksi, n=9, R=223 psi]



10. A post-tensioned bonded concrete beam has a prestress of 1600 kN in the steel immediately after prestressing, which eventually reduces to 1400 kN due to losses. The beam carries live load of 30 kN/m in addition to its own weight of 5.76 kN/m.
Compute the extreme fiber stress at the section A-A shown in figure below.
    i. At the initial condition with full prestress and no live load
    ii. At the final condition, after the losses have taken place with full live load



PART B

[There are 4 (four) questions. Answer any **3 (three)**]

11. a) What are corner reinforcements in two-way slab? Write down the ACI provision for corner reinforcements.
    b) What is flat slab? Write down the advantages and disadvantages of flat slabs.
    c) Mention the conditions necessary for using the Direct Design Method of flat slab analysis.

12. a) Explain why punching shear is considered in the design of column footings but not for wall footings.
    b) Define the band-width in placing reinforcements for rectangular footings and explain why it is used.
    c) What is Transverse Beam in combined footings?

13. a) "The application of compressive load may increase or decrease the moment capacity of columns." – Explain briefly.
    b) Why is it not advisable to use single piles under columns?
    c) What is retaining wall? Name different types of retaining walls and explain their relative advantages.

14. a) What is pre-stressed concrete? Write down the advantages and limitations of prestressing.
    b) Define: i. External Prestressing and Internal Prestressing, ii. Full, Limited and Partial Prestressing.
    c) What is loss of prestress? Mention different types of loss of prestress.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures II | Credit Hours: 3.0 | Course Code: CE 317
Time: 3 hours | Full Marks: 100 (= 10 × 10)

PART A

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

[Given: $f_c' = 4$ ksi, $f_y = 60$ ksi for all questions except Question No. 10]

1. Fig. 1(a) shows the 5″ thick RC slab S_1 supported on 12″-wide beams, to be designed (by WSD) for floor loads including FF = 30 psf, RW = 50 psf and LL = 60 psf. Calculate the
   (i) Required slab reinforcements,
   (ii) Design LL if same reinforcements are used for S_2 in Fig. 1(b).

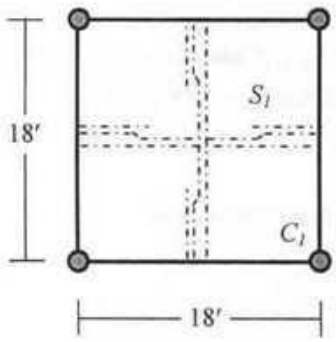


Fig. 1(a)

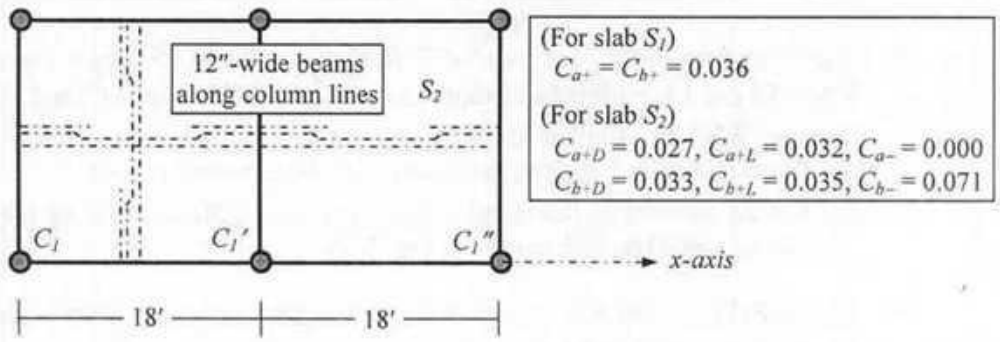


Fig. 1(b)

2. Figs. 1(a), 1(b) show floor plans consisting of 5″ thick slabs S_1, S_2 (supported on 12″ × 18″ beams) with floor loads FF = 30 psf, RW = 50 psf, as well as 5″ thick brick walls along column lines.
   (i) Use WSD to design two sections of circular column C_1 (with steel ratios 1% and 4%) in Fig. 1(a), assuming it to be subjected to axial force only from a 6-storied structure, with slab LL = 60 psf.
   (ii) Use both sections obtained in (i) for column C_1' to calculate allowable LL on slab S_2 (using USD) [Fig. 1(b)].

3. For floor plans (of 6-storied structures) shown in Fig. 1(a), 1(b) and loaded as described in Question 2 (with slab LL = 60 psf), determine the size and thickness (using WSD for punching shear only) of
   (i) Square footing (F_1) supporting circular column C_1 (of 12″-dia) in Fig. 1(a),
   (ii) Rectangular footing (of same width as calculated in (i) for F_1) supporting 16″-dia circular column C_1' in Fig. 1(b)
   [Given: Allowable bearing capacity of the soil = 3 ksf].

4. For the floor plan of a 6-storied structure shown in Fig. 1(b) and loaded as described in Question 2,
   (i) Determine the size and thickness (using USD for punching shear only) of a combined footing supporting circular columns C_1 (12″-dia), C_1' (16″-dia) and C_1'' (12″-dia), if the footing length (in the x-direction) is limited to 40 ft
   (ii) Design the transverse beam below column C_1' (using USD)
   [Given: Allowable bearing capacity of the soil = 3 ksf].

5. Fig. 2 shows a pile-group supporting 16″-dia circular column C_1' of the 6-storied structure shown in Fig. 1(b) and loaded as described in Question 2. If each pile in the group is 40′-long and has a diameter of 12″, use WSD to calculate the
   (i) Axial force capacity of each pile
   (ii) Allowable bending moment M_x (about x-axis) for the pile group
   [Given: Allowable bearing capacity of the soil = 1 ksf].

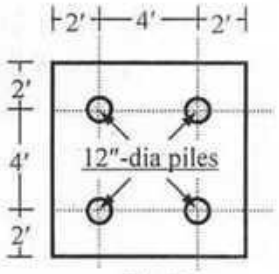


Fig. 2

6. Fig. 3(a) shows 7″ thick flat slab FS_1 supported on 15″ × 15″ columns and designed (by USD) for floor loads including FF = 30 psf, RW = 50 psf and LL = 60 psf. Calculate the
   (i) Required reinforcements in slab column strip,
   (ii) Design LL if same reinforcements are used for FS_2 in Fig. 2(b).

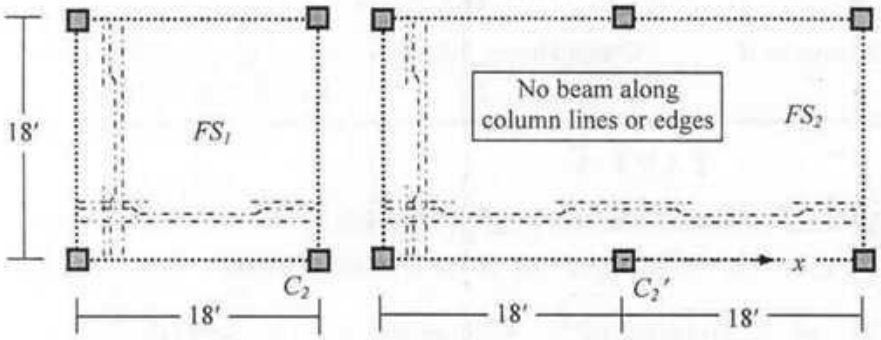


Fig. 3(a)

(Distribution factors for M_0 in FS_1)
$C_{Ext-} = 0.26$, $C_{Mid-} = 0.74$

Fig. 3(b)

(Distribution factors for M_0 in FS_2)
$C_{Ext-} = 0.26$, $C_{Mid-} = 0.52$, $C_{Int-} = 0.70$

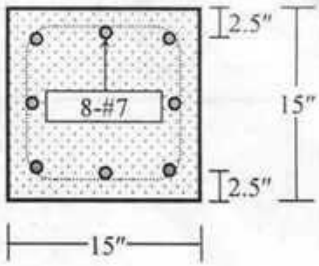


Fig. 3(c)

Column section C_2, C_2'

7. Figs. 3(a), 3(b) show floor plans of 7″ thick flat slabs FS_1, FS_2 carrying working floor loads FF = 30 psf, RW = 50 psf, LL = 60 psf and supported on 15″ × 15″ columns C_2 and C_2' [section in Fig. 3(c)].
   (i) Use WSD to calculate the allowable axial force (P_a) on section C_2 and the allowable number of floors shown in Fig. 3(a), assuming C_2 to be subjected to axial force only.
   (ii) For the number of floors calculated in (i), use USD to calculate the allowable bending moment M_x (about x-axis) on column C_2' in Fig. 3(b).

8. For the RC retaining wall shown in Fig. 4 along with pressure diagram on its foundation, calculate the
   (i) Total weight W (k/ft) on the foundation (heel and toe) and the corresponding distance x [Given: Unit weight of concrete = 150 lb/ft^3, Unit weight of soil = 110 lb/ft^3]
   (ii) Surcharge pressure w (ksf) and horizontal force H (k/ft) resulting in the pressure diagram shown
   (iii) Factor of safety against sliding and overturning.

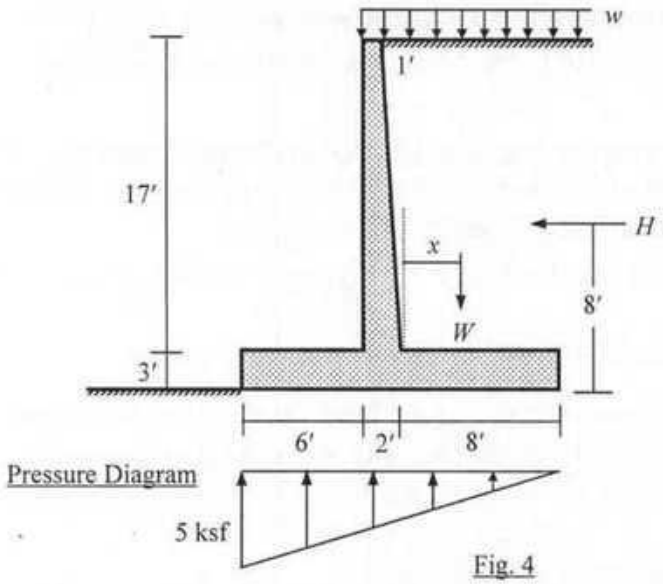


Fig. 4

9. (i) Use USD to design the heel and toe of the retaining wall in Fig. 4, using the pressure diagram,
   (ii) Show the reinforcements calculated in (i) with neat sketches.

10. Fig. 5 shows a simply-supported concrete beam AB subjected to pre-stressing force of 250 kips that reduces to 200 kips after losses.

(i) For both sections of the beam (i.e., Section1 and Section 2), calculate the

(a) Extreme fiber stresses at support A and midspan of the beam at working condition (i.e., with effective prestress and beam self-weight)

(b) Cracking moment and corresponding distributed load w on the beam

[Given: $f_c' = 6$ ksi, $f_{ci} = 4.5$ ksi]

(ii) Comment on the suitability of the sections based on the results obtained in (i).

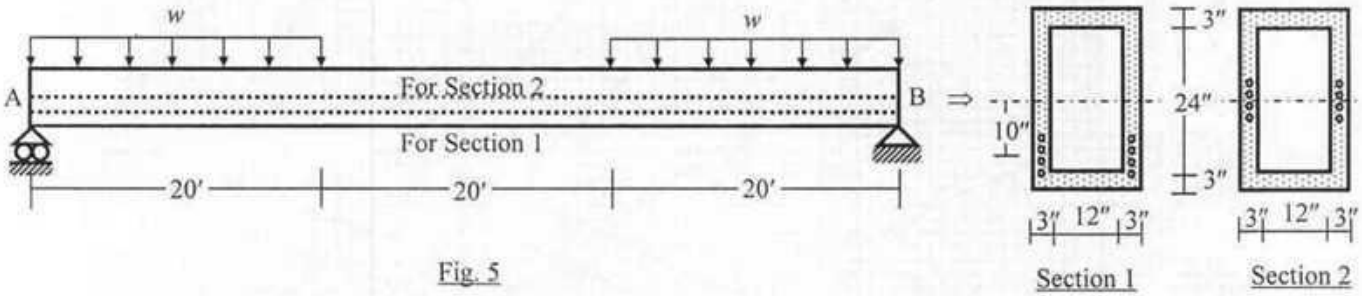


Fig. 5

PART B

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

11. (i) Explain (with appropriate diagrams) why the moments calculated for middle strip reduces near supports for beam-supported slabs but increases for flat slabs.

(ii) Explain why shear reinforcements are often necessary for flat slabs but not beam-supported slabs. Briefly outline the design provisions for two types of shear reinforcement in flat slabs.

12. (i) Explain why transverse reinforcements are used in RC columns. Mention the ACI recommendations for the size, spacing and arrangement of lateral ties.

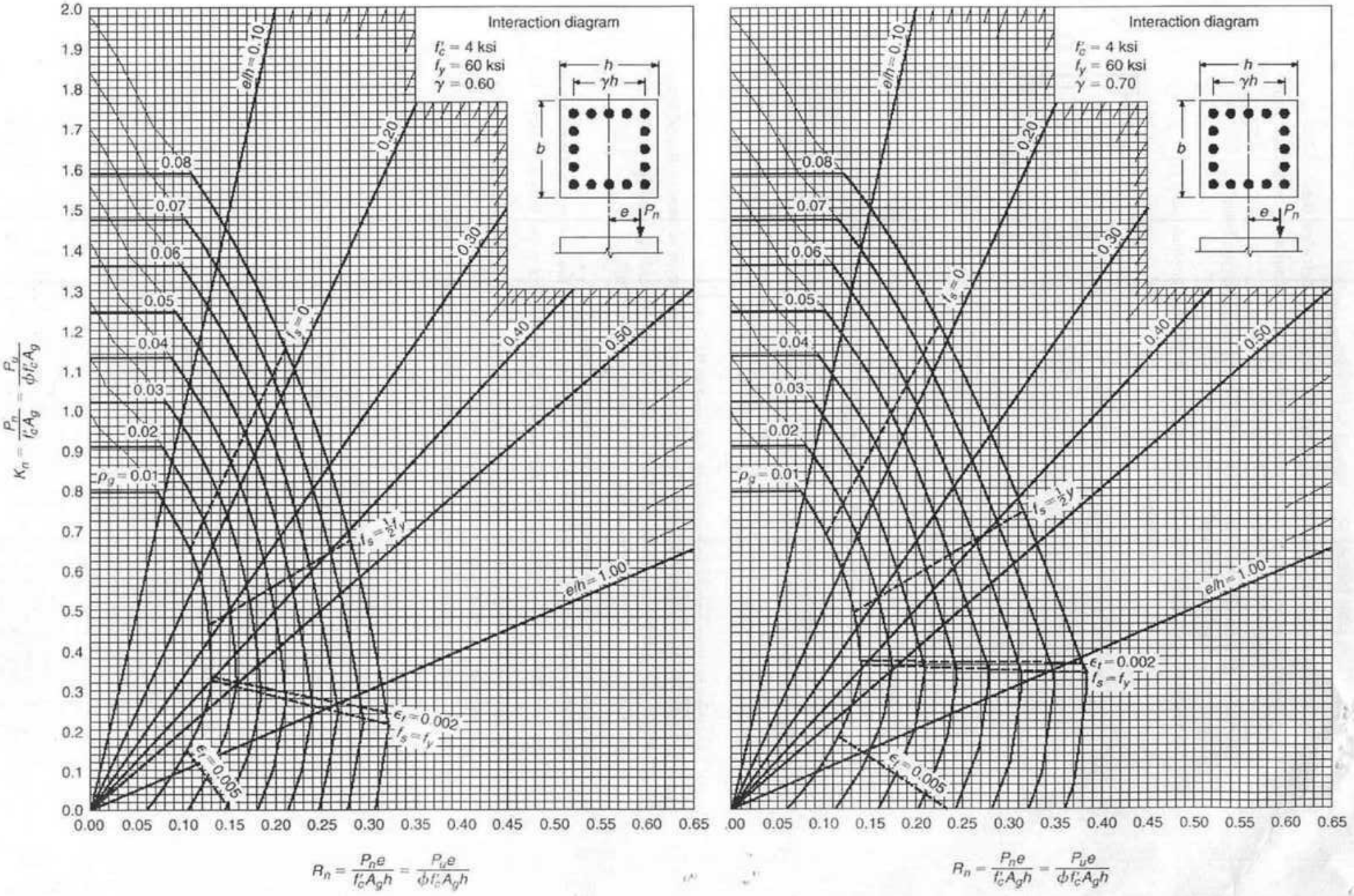
(ii) Narrate the differences between the structural design (including loading, design provisions and reinforcements) of wall footings and individual column footings.

13. (i) Why is it not advisable to use single piles under columns? Show pile arrangements in different pile groups and mention the recommendations for pile spacing.

(ii) Mention various types of combined footings and briefly explain when they are used.

14. (i) Explain why it is important to prevent the accumulation of water behind retaining walls. Also mention some possible measures to be taken in this regard.

(ii) Explain why it is important to use high strength concrete in pre-stressed concrete.


Interaction diagram
f'_c = 4 ksi
f_y = 60 ksi
γ = 0.60
h
γh
b
e
P_n
e/h = 0.10
0.20
0.30
0.40
0.50
e/h = 1.00
0.08
0.07
0.06
0.05
0.04
0.03
0.02
ρ_g = 0.01
$f_s = 0$
$f_s = \frac{1}{2}f_y$
ϵ_t = 0.002
$f_s = f_y$
ϵ_t = 0.005
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$
Interaction diagram
f'_c = 4 ksi
f_y = 60 ksi
γ = 0.70
h
γh
b
e
P_n
e/h = 0.10
0.20
0.30
0.40
0.50
e/h = 1.00
0.08
0.07
0.06
0.05
0.04
0.03
0.02
ρ_g = 0.01
$f_s = 0$
$f_s = \frac{1}{2}f_y$
ϵ_t = 0.002
$f_s = f_y$
ϵ_t = 0.005
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$

3-1

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

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

Question No. 6 is compulsory. Answer any FOUR from the rest.
(Note: Assume any missing data and answer as per given notes.)

1. (a) Discuss briefly the coagulation and flocculation theory and process in conventional water treatment process. (12)

   (b) Explain **"Use screen length as a controlling factor".** (3)

   (c) Results of chlorine demand test on a raw water are given below: (5)

Sample no.	Chlorine dosage (mg/lt)	Residual chlorine after 10 min contact(mg/lt)
1.	0.2	0.19
2.	0.4	0.36
3.	0.6	0.50
4.	0.8	0.48
5.	1.0	0.2
6.	1.2	0.4
7.	1.4	0.6
8.	1.6	0.8

   Sketch a "chlorine demand curve". What is the "break point dosage" and what is the "chlorine demand" at dosage of 1.2 mg/lt ?

2. (a) Discuss briefly the disinfecting action of chlorine in water treatment process. (9)

   (b) Define rain water, ground water, potable water and palatable water. (4)

   (c) Write down the advantages of pressure pipe over gravity pipe. (3)

   (d) What are the short comings of Tara pumps ? (4)

3. (a) Classify the impurities in water according to the source of origin and form of presence. (note: show the classification in a table format) (9)

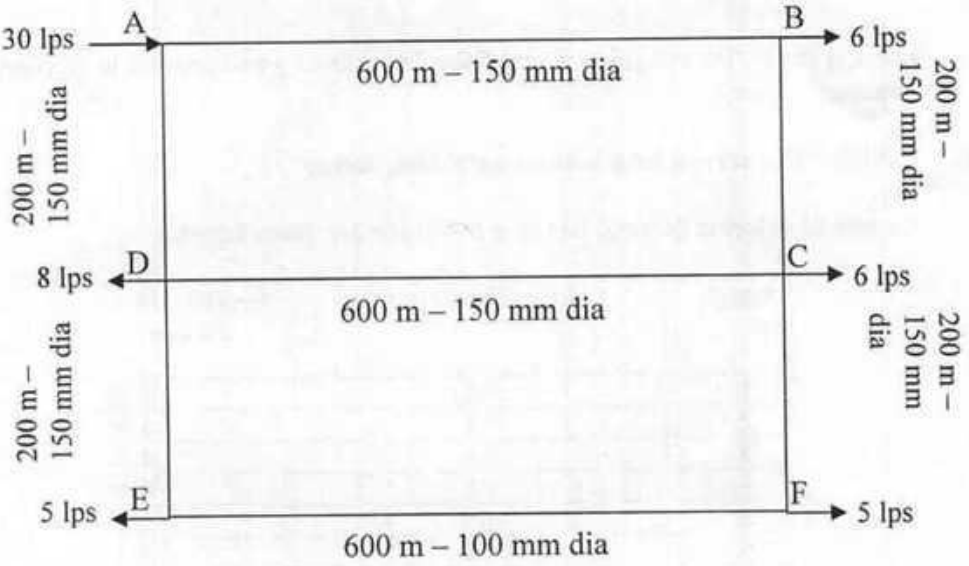
   (b) Write down the important considerations for selection of site for intake structures. (6)

   (c) The discharge of water flowing from a reservoir into a 1m dia steel pipe is 1.6 m^3/sec. If a valve is situated in the pipe-line at a point 2 km from the reservoir , evaluate water hammer pressure developed by the closure of this valve, if (5)

I. The closure time is 2.8 sec
II. The closure time is 5.5 sec

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

4. (a) Calculate the flow in each of the pipes in the following looped pipe network (using Hardy Cross method and two trials are required): (20)



5. (a) What is the principle of particles to settle in sedimentation tank during sedimentation process ? What are parameters that the settling velocity of the particles depend upon ? (3+3)

(b) Differentiate between slow sand filter (SSF) and rapid sand filter (RSF). (4)

(c) Differentiate between working pressure, design pressure and test pressure in a pipe. (5)

(d) A rapid sand filter is to be designed for a capacity of 30,000 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)

[Assume : Rate of filtration : 5 $m^3/hr/m^2$
Rate of washing : $35m^3/hr/m^2$
Length of the filter run: 23.67 hrs while 8 min. and 12 mins are required. for filter washing and resettlement of sand bed respectively]

6. (a) Design a tube well of a suitable aquifer for extracting drinking water at a depth from 280 ft to 340 ft. In the following graph the co-ordinates should be identified. (20)
(Summary of grain size test report, gradation chart & all relevant data are given below).

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. $T_C = 2S/U_P$

Summary of Grain Size Test Results:

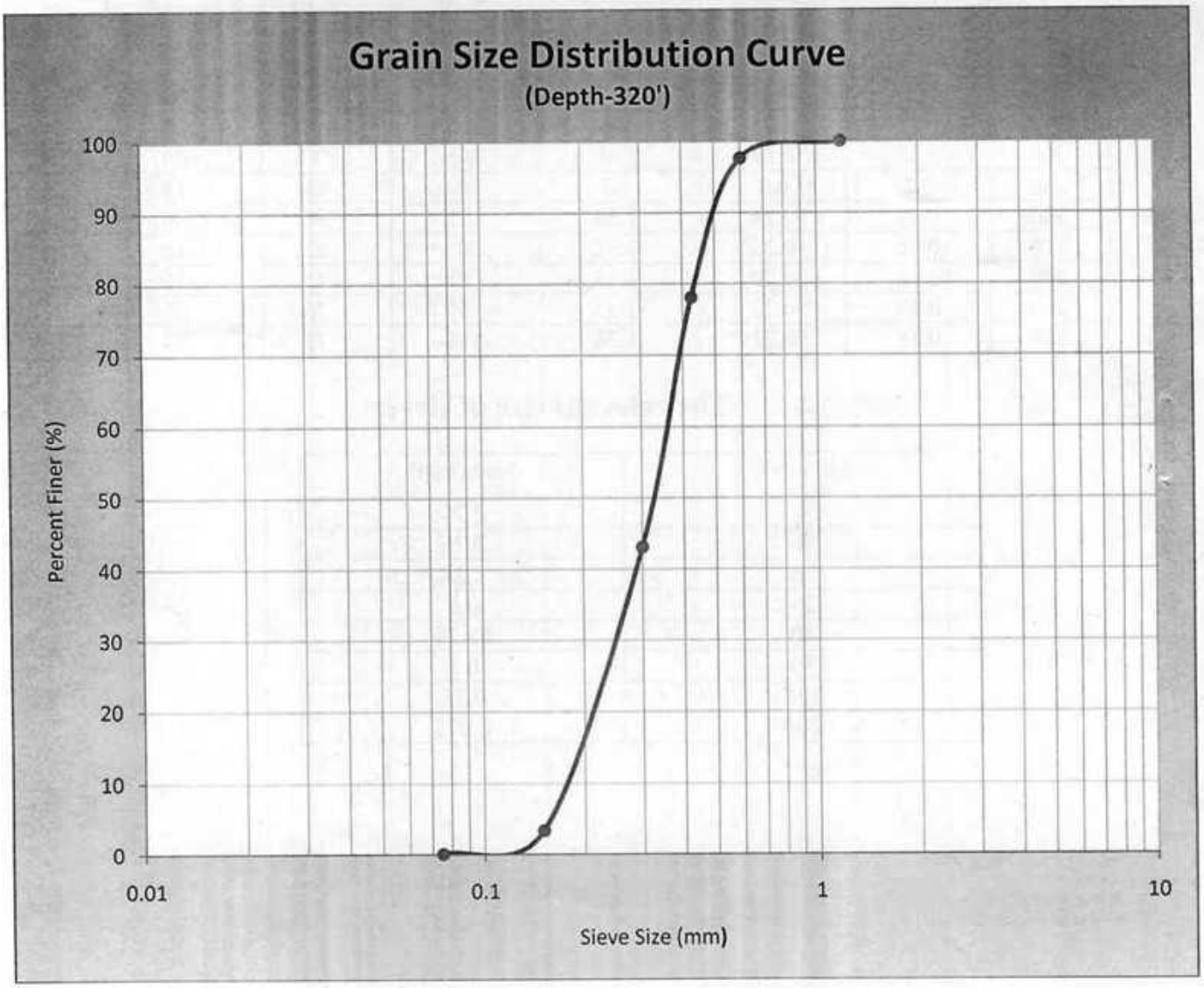
Sample depth	D_{10}	D_{30}	$U= D_{60}/D_{10}$	% of Coarse Sand	% of Medium Sand	% of Fine Sand	FM
(ft)	mm	mm		%	%	%	
240	0.17	0.25	1.4	0.5	89.5	20	1.5
260	0.18	0.24	1.46	0.5	89.5	20	1.49
280	0.2	0.3	1.3	4	86	10	1.68
300	0.15	0.24	1.58	12	68	20	1.60
320	0.18	0.25	1.52	2	82	16	1.56
340	0.18	0.27	1.11	10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

The relevant size of sieves

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

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

(The co-ordinates should be identified in graph.)



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II | Course Code: CE 333

Time: 3.0 hours | Full Marks: 150(=5×30)

[Answer any 5 (Five) of the following 7 (Seven) questions]

[Assume reasonable values for any missing data]

1. (a) Is pour-flush a hygienic latrine? Justify your answer. 5

   (b) Design a simple pit latrine for a family of 9 persons for a design life of 4 years. GWT is 8 m below ground surface. After using the latrine for 1.5 years, the users want to upgrade the latrine into a single pit pour-flush latrine so that the same pit can be used repeatedly with regular desludging. Determine total life of the pit before emptying for the first cycle. Assume reasonable value for any missing data. I = 30 l/m^2-d, q= 9 lpcd. 15

   (c) Describe the four important processes that take place in a septic tank. 10

2. (a) An apartment building houses has 30 residents generating an average wastewater flow rate of 160 lpcd. Design a septic tank for the building that will be desludged every 3 years. For ensuring better effluent quality, it is recommended that the minimum hydraulic retention time for the tank be 1.0 (one) day. Due to space constraints, specific tank area has to be restricted within 12 m^2. Assume wastewater temperature within the tank to be 25°C. Check clear space depth. Draw a net sketch showing details of septic tank dimensions and depth of different zones. 20

   (b) Compare the following: 5+5

   (i) On-site and Off-site sanitation system

   (ii) Separate and Combined sewer system

3. (a) Discuss the changes in the design criteria for Small Bore Sewerage System (SBS) compared to the Conventional Sewage System? 10

   (b) What are the requirements that an ideal drain section should meet? 5

   (c) Where the manholes are usually located? 5

   (d) Design a facultative and maturation pond to treat 8,000 m^3/d of domestic sewage with a BOD_5 of 560 mg/L and Fecal Coliform of 3×10^7 FC/100 ml. The design temp is 25°C and the required effluent standards are: BOD_5< 50 mg/l, FC < 5000/100 ml. Assume the values of k_b and k as 2.6 d^{-1} and 0.3 d^{-1} in 20°C respectively. 10

4. (a) Describe the form of biological processes in a trickling filter along with the diagram. 10

(b) Discuss the metabolism of bacteria with necessary reactions. 5

(c) A city discharges 1.3 m^3/s of sewage into a stream whose minimum rate of flow is 8.1 m^3/s. The velocity of stream is 3.3 km/h. The temperature of the sewage is 20°C and that of the water of stream is 15°C. The 21°C BOD_5 of the sewage is 210 mg/l and that of the stream water is 2 mg/l. The sewage contains no DO while the stream is 95% saturated with dissolved oxygen. The values of de-oxygenation rate constant and re-oxygenation (re-aeration) rate constant at 20°C are $0.3d^{-1}$ and $0.7d^{-1}$ respectively. Use the temperature coefficient of 1.135 for K_1 and 1.024 for K_2. Determine - 15
The critical oxygen deficit, critical (minimum) DO and its location.

5. (a) Discuss the relationship among growth phase, F/M ratio, waste removal rate and biomass settling characteristics in a table. 8

(b) Describe the symbiosis of Bacteria and Algae. 5

(c) Describe pattern of pollution and self-purification of a stream and its effect on biological life. 10

(d) Compute the recirculation ratio to obtain 85% BOD removal (20 degree Celsius), using a depth of 6 feet and a hydraulic loading of 17 mgad at 20 degree Celsius. What efficiency would be expected at 29 degree Celsius? 7

6. (a) Discuss endogenous respiration. The exerted BOD_5 of wastewater is determined to be 165 ppm at 20°C. Determine its exerted BOD values for 9-day 25°C and 10-day 10°C. Assume k_1 (20°C) = 0.23 per day.k_1 (T degree Celsius) = k_1 (20 degree Celsius) $\Theta^{(T-20)}$; and Θ = 1.087 2+6

(b) What are the effects of pH, temperature and food source on bacterial activity and BOD_5? 6

(c) What are the advantages and disadvantages of disposal for sewage effluent on land by irrigation? 6

(d) Discuss the significance of Food-Microorganism (F/M) ratio in activated sludge process. 10

7. (a) Residential area (shown in figure 1) is severed by sewer P1. At present it has a total of 200 numbers 4 storied building with two flats on each floor. The average occupancy is 6 persons per flat. The per capita water demand is 210 liter per day. The segment of sewer (P1) between man holes MH1 and MH2 is servicing the area using the following data: 20
i) pipe length = 300m; ii) per capita waste water generation rate is 80% of water use
iii) peak factor = 2.9; iv) peak infiltration rate = 0.26 m^3/ha/day;
v) Area = 190 ha [Assume reasonable value for missing data.]
vi) Manning's roughness coefficient for sewer is 0.013. If a 450 mm diameter pipe is provided, will that be adequate? The nomograph is attached with this question paper.

(b) Discuss the following preliminary treatment methods: 10
Screening, comminutor, grit chamber and skimming tank.

Formulae:

1. $BOD_5 = L_0 - L_t = L_0(1-10^{-k_1 t})$
2. $k_{1\ (T\ degree\ Celsius)} = k_{1\ (20\ degree\ Celsius)}\ \Theta^{(T-20)}$
3. $L_e/L_f = 1/\{1+2.5\ (D^{0.67}/Q^{.5})\}$
4. $L_f = (L_i + RL_e)/(1+R)$
5. $L_e/L_i = 1/[(1+R)\{1+2.5\ (D^{0.67}/Q^{0.5})\}-R]$
6. $E_T = E_{20}\ 1.035^{(T-20)}$
7. $D_t = \frac{K_1 L_a}{K_2 - K_1}\left(e^{-K_1 t} - e^{-K_2 t}\right) + D_a . e^{-K_2 t}$
8. $t_c = \frac{1}{K_2 - K_1} \ln\left\{\frac{K_2}{K_1}\left(1 - \frac{D_a(K_2 - K_1)}{K_1 L_a}\right)\right\}$
9. $D_c = \frac{K_1}{K_2} L_a . e^{-K_1 t_c}$
10. V=CPN
11. $t_h = 1.5 - 0.3 \log (Pq)$
12. $V_h = 10^{-3} P q t_h$
13. $t_d = 30\ (1.035)^{35-T}$
14. $V_d = 0.5 \times 10^{-3} P t_d$
15. $d_{sc} = 0.82 - 0.26A$
16. $V_i = QD / 4I$
17. $L_e = L_i / (1+kt)$, $k_T = k_{20}$ X $(1.05)^{T-20}$,
18. $\lambda_s = 10LiQ/A$ (unit= kg/ha-d), λ_s (allowable) = 20T -120 (unit = kg/had),
19. $N_e = N_i / (1+k_b t)$, k_b (T degree Celsius) = k_b (20 degree Celsius) X $(1.19)^{T-20}$

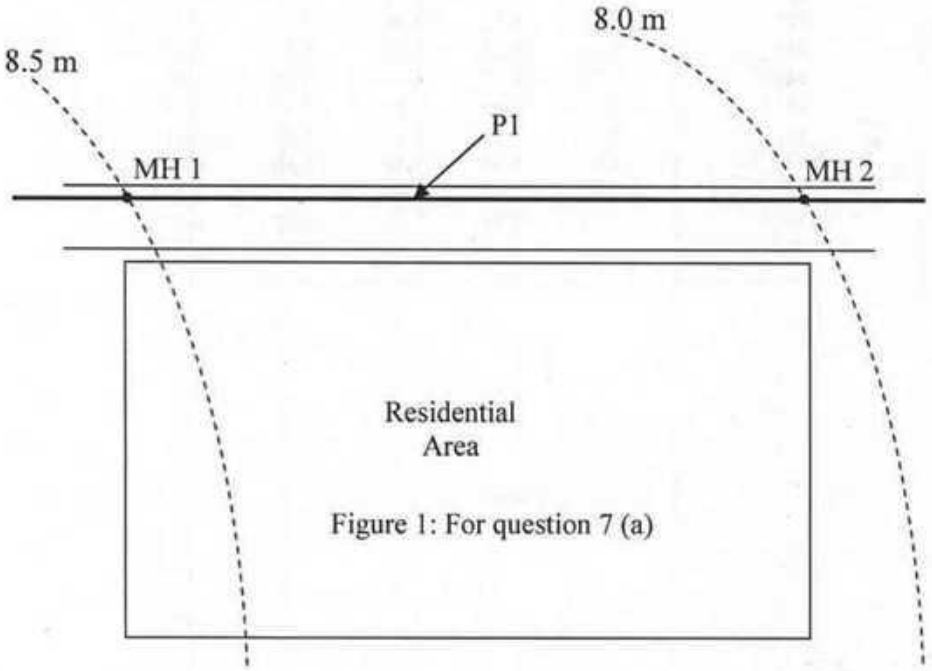
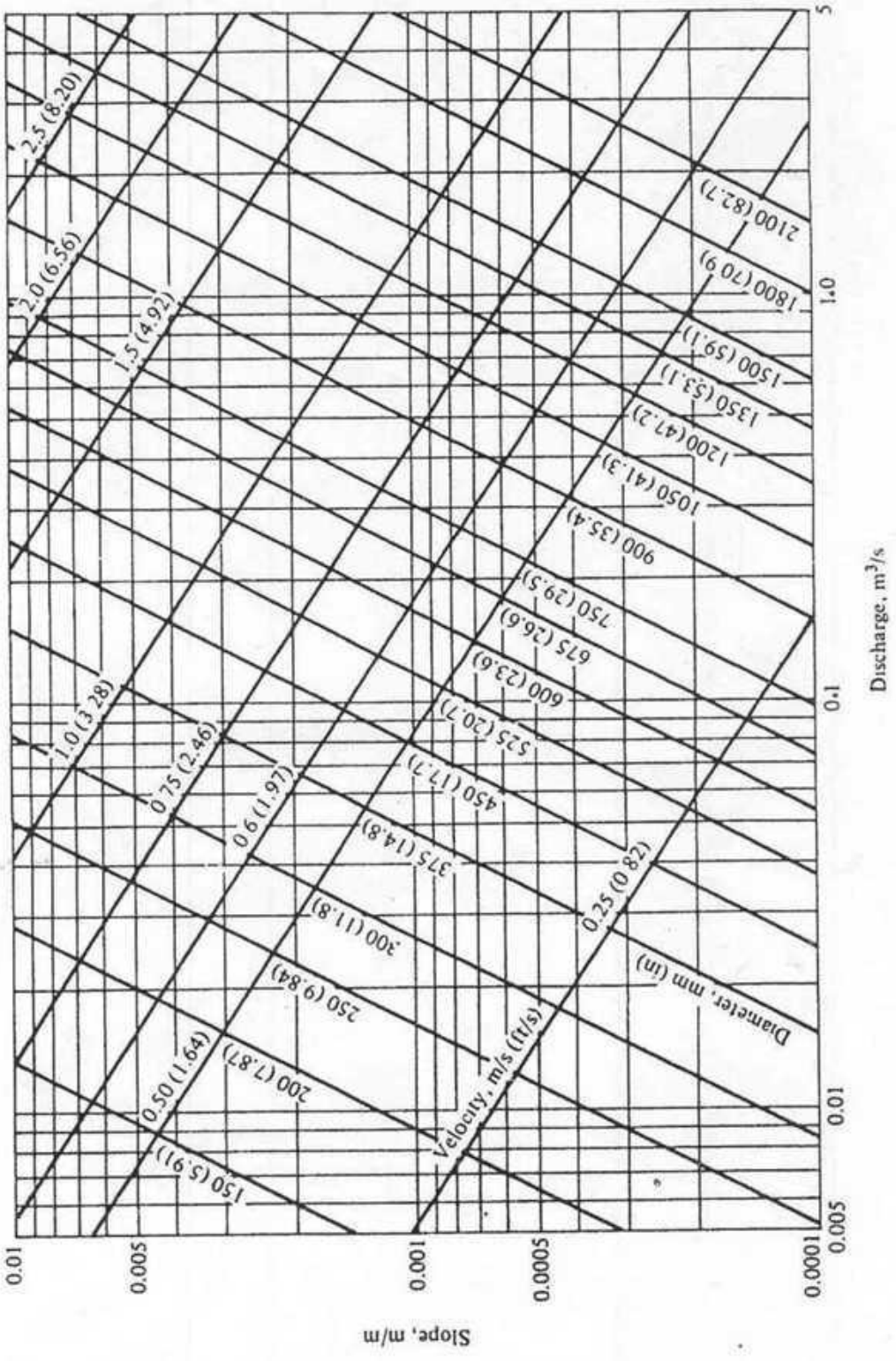


Figure 1: For question 7 (a)

Table: Equilibrium concentrations (mg/l) of DO as a function of temperature and chloride

Temperature, °C	Chloride concentration, mg/L				
	0	5,000	10,000	15,000	20,000
0	14.62	13.79	12.97	12.14	11.32
1	14.23	13.41	12.61	11.82	11.03
2	13.84	13.05	12.28	11.52	10.76
3	13.48	12.72	11.98	11.24	10.50
4	13.13	12.41	11.69	10.97	10.25
5	12.80	12.09	11.39	10.70	10.01
6	12.48	11.79	11.12	10.45	9.78
7	12.17	11.51	10.85	10.21	9.57
8	11.87	11.24	10.61	9.98	9.36
9	11.59	10.97	10.36	9.76	9.17
10	11.33	10.73	10.13	9.55	8.98
11	11.08	10.49	9.92	9.35	8.80
12	10.83	10.28	9.72	9.17	8.62
13	10.60	10.05	9.52	8.98	8.46
14	10.37	9.85	9.32	8.80	8.30
15	10.15	9.65	9.14	8.63	8.14
16	9.95	9.46	8.96	8.47	7.99
17	9.74	9.26	8.78	8.30	7.84
18	9.54	9.07	8.62	8.15	7.70
19	9.35	8.89	8.45	8.00	7.56
20	9.17	8.73	8.30	7.86	7.42
21	8.99	8.57	8.14	7.71	7.28
22	8.83	8.42	7.99	7.57	7.14
23	8.68	8.27	7.85	7.43	7.00
24	8.53	8.12	7.71	7.30	6.87
25	8.38	7.96	7.56	7.15	6.74
26	8.22	7.81	7.42	7.02	6.61
27	8.07	7.67	7.28	6.88	6.49
28	7.92	7.53	7.14	6.75	6.37
29	7.77	7.39	7.00	6.62	6.25
30	7.63	7.25	6.86	6.49	6.13



Nomograph for solution of Manning's equation for n = 0.013

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

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

Section A
There are 5 questions. Answer any 4 questions. **(4x10=40 marks)**

1. a) Define: (i) Specific gravity, (ii) Porosity, (iii) Hydraulic gradient 3
b) Derive the expression relating degree of saturation (S), void ratio (e), water content (w) and specific gravity (G_s). 4
c) Compare (qualitatively) T_{60} (time factor for 60% consolidation), t_{60} (time required for 60% consolidation), c_v (coefficient of consolidation) between the two cases of boundary condition for a given clay soil: (i) clay layer exists in between two sand layers, (ii) clay layer exists in between a sand layer and an impervious layer. What is the difference in drainage condition during consolidation in both cases? 3

2. a) Define: (i) Effective size, (ii) Plasticity Index, (iii) Effective stress 3
b) How is the total soil stress increased? Mention two causes only. 2
c) Describe the effect of particle sizes on the behaviour of coarse grained and fine grained soils. 2
d) Identify at-rest, active and passive cases for the given conditions: (i) retaining wall is moving away from the backfill material, (ii) retaining wall is moving towards the backfill material, and (iii) retaining wall is not moving at all. 1.5
e) Write on secondary consolidation process. When can it be expected (before or after primary consolidation)? Which type of soil may experience secondary consolidation settlement? 1.5

3. a) Define: (i) OCR, (ii) Swelling index, (iii) OMC 3
b) Differentiate the three types (CU, UU and CD) of Triaxial tests. 3
c)Discuss on the Mohr-Coulomb failure envelop and the shear strength parameters. 2
d)Write on total stress, effective stress and pore water pressure in a soil medium. 2

4. a) Write on different laboratory tests of fine grained soil. Which tests are required to classify a fine grained soil according to unified soil classification system? 3
b) What is Darcy's Law and mention about its validity for all three types of flow (laminar, transitional and turbulent)? 2
c) Calculate the time required to complete 90% consolidation for a 5 m deep saturated clay layer which is subjected to one-way drainage. Given that a sample from the mid depth from the clay layer was found to complete 60% of primary consolidation settlement in 48 hours during one dimensional oedometer test in the laboratory. 4
d) Name the laboratory tests for consolidation, compaction and permeability (for coarse grained and fine grained soils). 1

5. a) Pre-consolidation pressure at the mid level of a given saturated clay layer is found 500 psf. Classify the clay soils for the following cases: (i) When present overburden pressure is 450 psf, (ii) When present overburden pressure is 500 psf, and (iii) When present overburden pressure is increased to 700 psf. In which case pre-consolidation pressure is not 500 psf and what is the new value of pre-consolidation pressure? 2.5

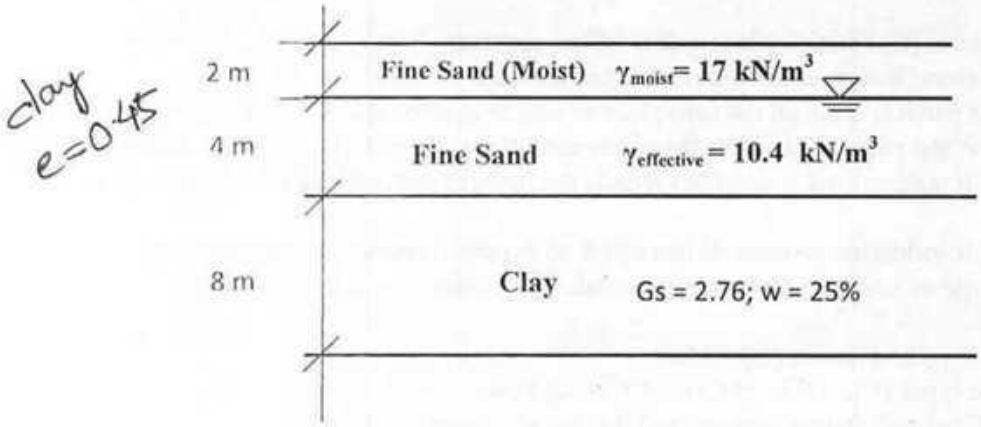
b) Discuss on the particle size distribution curve and the constants derived from this curve. 2.5

c) Derive the expression of the coefficient of active earth pressure as a function of angle of internal friction (φ) for cohessionless soil. 5

Section B

There are eight questions. Answer any 6 questions. (6x10 = 60 marks)

6. A clay stratum of thickness 8 m is located at a depth of 6 m below the ground surface. It is overlain by fine sand. The water table is located at a depth of 2 m below the ground surface. For fine sand, effective unit weight is 10.4 kN/m^3. The moist unit weight of sand located above water table is 17 kN/m^3. For clay layer, G_s = 2.76 and water content (w) is 25%. Compute the effective stress, the total stress and the pore water pressure at the bottom of the clay layer.



7. A concentrated load, 90 kN, acts on the surface of a soil mass. Using Boussinesq analysis [$\sigma_z = \frac{3Qz^3}{2\pi.(r^2+z^2)^{5/2}}$]. (a) Find the vertical stresses for the following points:

(i) 2 m below the surface along the axis of loading;

(ii) 2 m below the surface and 3 m (radial distance) away from the load and

(iii) 2 m below the surface and 6 m (radial distance) away from the load

(b) Draw the horizontal stress distribution at a depth of 2 m using the stresses calculated for the given problem.

(c) Also draw the horizontal stress distribution at a depth of 6m. The magnitudes of stresses are not required.

8. (a) Classify subgrade soil A.

The properties of a subgrade soil (A) are found as follows:

Percent finer than 0.075 mm = 20%

Percent finer than 0.425 mm = 25%

Percent finer than 0.6 mm = 32%

Percent finer than 4.75 mm = 75%

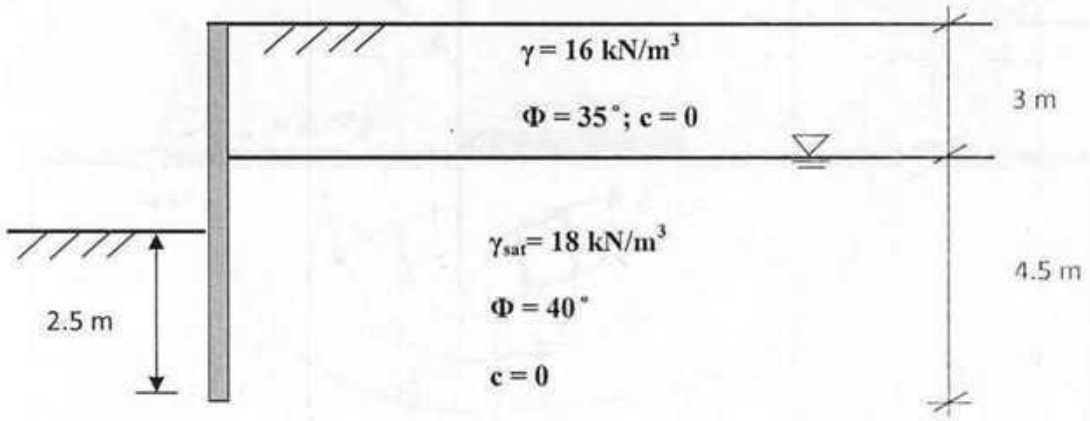
Liquid limit = 52% & Plastic limit = 35%

(b) The properties of a subgrade soil (B) are found as follows:

Percent of soil material in the pan = 4%

60% of the total soil material having a diameter less than 4.75 mm
30% of the total soil material having a diameter less than 1.18 mm
10% of the total soil material having a diameter less than 0.3 mm
Liquid limit = 33% & Plasticity index = 0%
What is the effective size of the soil? Calculate coefficient of curvature and plastic limit of the soil. Is the soil cohesive or cohesionless? Is it possible to observe this soil in plastic state?

9. Find the magnitude and location of the active force (per unit width) on the retaining wall, shown below, for the Rankine state.



10. The following table gives data obtained from a direct shear test conducted on samples of compacted sand. The cross-section of the shear box is 60 mm x 60 mm. Plot the Mohr Coulomb failure envelop and determine the values of the shear strength parameters for the data given in the table. Use graph paper. Units of all parameters must be mentioned.

Normal Load (kN)	Shear Load (kN)
60	95
160	195
260	294

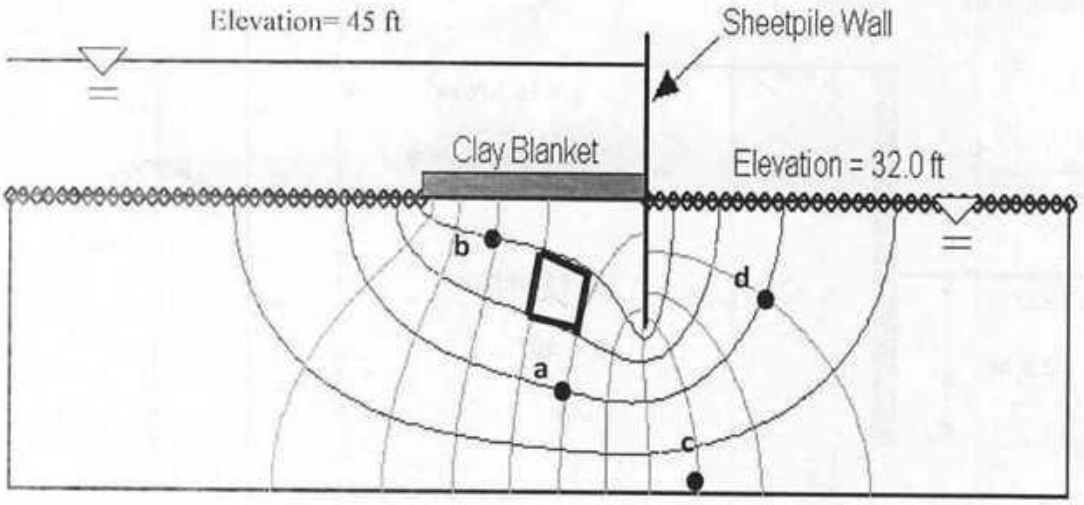
11. The following observations were made in a Standard Proctor Test.

Trial No.	1	2	3	4	5	6
Mass of wet soil (kg)	1.7	1.89	2.03	1.99	1.96	1.92
Water content (%)	11.2	14.7	20	25	27.8	33.1

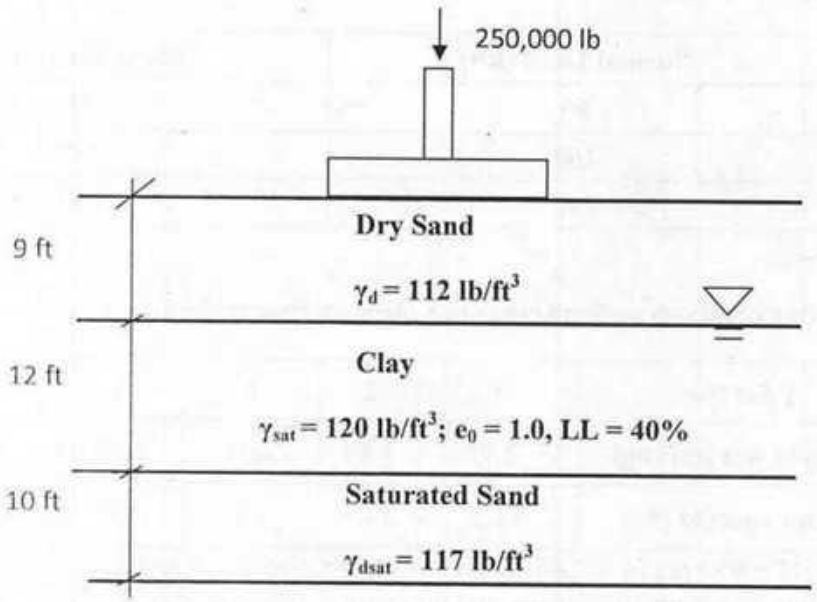
Volume of Mold = 950 cc; G_s = 2.65. Draw the compaction curve and also show the zero air void line on the graph. Determine maximum dry density and optimum moisture content.

12. Calculate the following for the seepage flow shown below. (a) Heights of water in the piezometer, if installed at a, b, c and d; (b) Hydraulic gradient, i for the flow element highlighted in the figure.The flow element is an approximate square having 4 ft of each side; (c) Total seepage flow rate.

$K = 0.025$ ft/s



13. Calculate the primary consolidation settlement for the 12 ft thick clay layer (as shown below) due to the load carried by a square footing of size 7 ft x 7ft. The clay is normally consolidated. Use the average method to calculate the average increase of pressure in the clay layer.



Given that: Cc = 0.009(LL – 10); Stress increase at the top of the clay layer, $\Delta\sigma_t = 0.055 * \sigma_{applied}$; Stress increase at the middle of the clay layer, $\Delta\sigma_m = 0.028 * \sigma_{applied}$; Stress increase at the bottom of the clay layer, $\Delta\sigma_b = 0.02 * \sigma_{applied}$; Average stress increase, $\Delta\sigma = (2\,\Delta\sigma_t + 4\,\Delta\sigma_m + 3\,\Delta\sigma_b) / 9$

THE UNIVERSITY OF ASIA PACIFIC
DEPARTMENT OF CIVIL ENGINEERING
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Title: Transportation Engineering I: Transport and Traffic Design
Course Code: CE 351
Full Marks: 300
Time: 3:00 hours

THE FIGURES IN THE MARGIN INDICATE FULL MARKS.
Assume reasonable values for any missing data.
There are EIGHT questions. Answer any SIX questions.

1. (a) Explain the main problems associated with the development of road infrastructure and plausible causes of premature failure of pavement in Bangladesh. (25)
(b) Briefly mention the main weaknesses of Dhaka City in particular relation to transportation system. (25)

2.(a) Write down the objectives and methods of carrying out traffic speed and delay studies? Differentiate between Space-mean-speed and Time-mean-speed. (30)
(b) The following travel times were observed for 5 vehicles traversing a 2 km segment of highway:

Vehicle	Time (min)
1	1.8
2	1.3
3	1.9
4	1.7
5	2.1

Calculate the space and time-mean-speeds of the vehicles (8)

(c) Spot speed data were collected at a section of highway during an improvement work. The speed characteristics are given below. Determine whether there was any significant difference between the average speed at the 95% confidence level. (12)

$U_1 = 35.2$ Mph $\quad U_2 = 47.4$ mph
$S_1 = 5.4$ Mph $\quad S_2 = 8.9$ mph
$n_1 = 385 \quad n_2 = 350$

3.(a) Differentiate between 'Non-recurrent congestion' & 'Recurrent congestion' and 'Fixed delay' & 'Operation delay'. (10)
(b) Following data were collected while conducting spot speed studies at certain stretch of a road within the urban area. Determine: (25)
- average speed, modal speed and pace of the traffic stream.
- upper and lower values of speed limits for regulation
- design speed for checking the geometric design

Speed Range (kmph)	No. of vehicle observed (f)
0 – 10	10
10 – 20	40
20 – 30	90
30 – 40	120
40 – 50	80
50 – 60	60
60 – 70	20
Total	420

(c) Differentiate between traffic signs and markings. Briefly discuss about the new trend of roadway signs. State the importance of retro-reflective marking and variable message signs (VMS). (15)

4.(a) Define design parking vehicle. List the locations where parking should be prohibited. Write down the relative advantages and disadvantages of parallel and angled parking. What steps should be undertaken for systematic development of parking facilities? (20)

(b) Why terminal is essential for a city and mention its proper location? Write down the general requirements of a terminal. Define: Terminal, Depot and Workshop. (15)

(c) State the primary objectives of providing street lighting. Design a street lighting system for the following data and draw the layout. Relevant tables and figures are given at the end of the script. (15)

Road	=	Urban Secondary
Pavement width	=	70 ft
Surface reflectance	=	20 %
Night time flow	=	1100 vph in both direction
Source of light	=	Sodium
Mounting height	=	30 ft
Maintenance factor	=	0.8

5 (a) List the benefits of traffic signal. Write down the functional classification of traffic signs and give two examples for each. What type of traffic signs is needed for priority typed intersections? (15)

(b) State the general requirements of traffic control devices. Write down the color and pattern convention of road markings. Mention the problems associated with traffic signals in Bangladesh. (15)

(c) Design a two-phase traffic signal for an isolated intersection. The following data are given: (20)

Amber period	= 3 sec; Red & Amber period = 2 sec
Inter-green period	= 6 sec for N-S phase and 7 sec for E-W phase
Initial and final lost times	= 3 sec for N-S phase and 2 sec for E-W phase

Approach	North	South	East	West
Arrival Flow (pcu/hr)	400	450	560	458
Saturation flow (pcu/hr)	1800	1780	1850	1780

Draw phase diagram and cycle time bar diagram.

(25)

6. (a) State the objectives of geometric design of highway? Discuss the factors which govern highway alignment. Briefly describe the traffic elements that influence highway design.

(b) Draw a typical highway cross-section and show different cross-sectional elements. (15)

(c) An existing vertical curve on a highway joins +3.0 % grade with a -2.0 % grade. If the length of the curve is 250 ft, what is the maximum safe speed on this curve? Assume f = 0.4 and perception-reaction time is 2.5 sec. Also assume S>L.

(10)

7. (a) Define DHV, Directional Distribution and Design Designation. Explain why the transition (spiral) curves are used in horizontal alignment. (15)

(b) What are the principal design criteria for highway? Discuss stopping sight distance (SSD) and passing sight distance (PSD). (15)

(c) Two roads are connected by a horizontal circular curve on level ground. Inside the circular curve there exists an obstruction which may reduce the availability of sight distance. Given the following data, calculate the stopping and passing sight distances required and sight distance available on the circular curve. Also provide your comments on the geometric design of the roadway. (20)

Data Given:

Distance from the center of the road to the edge of the obstruction, c = 120 ft
Radius of curvature along CL of inside lane, r = 750 ft
Design speed of the road, u = 50 mph
Avg. speed of passing vehicle = 50 mph
Avg. speed of passed vehicle = 40 mph

Assume:

Perception & brake-reaction time, t = 2.5 sec
Co-efficient of friction, f = 0.3
Avg. acceleration rate, a = 1.43 mph/sec
Time for preliminary delay, t_1 = 4 sec
Avg. time while passing vehicle occupies the opposite lane, t_2 = 10 sec
On the circular curve, the sight distance is given by, $S = 200/D*Cos^{-1}[(r - c)/r]$ ft

8 (a) What does it mean by "Level of Service (LOS)"? Name the measures of effectiveness, which qualitatively define "Level of Service (LOS)". (10)

(b) Enumerate the main purposes of roadway furniture? List different types of "Guardrails". Differentiate between "Curbs" and "Gutters". (15)

(c) List different types of horizontal and vertical curves. Mention different ways of attaining super-elevation. Briefly explain the purposes of proving 'curve widening' and 'climbing lane' in rural highway? (15)

(d) A horizontal curve having a radius of 800 ft forms part of a two lane highway that has a posted speed limit of 50 mph. If the highway has 0 % slope at this section, determine the minimum distance a large billboard can be placed from the centerline of the inside lane of the curve, without reducing the required SSD. Assume perception reaction time of 2.5 sec and f = 0.32. (10)

TABLES & FIGURES for Question 4 (c)

TABLE 1 RECOMMENDED AVERAGE ILLUMINATION (LUMENS/FT^2)

Pedestrian traffic[1]	Vehicular traffic[2] (vph)			
	Very light (<150 vph)	Light (150 – 500 vph)	Medium (500 – 1,200 vph)	Heavy (>1,200 vph)
Heavy	-	0.8	1.0	1.2
Medium	-	0.6	0.8	1.0
Light	0.2	0.4	0.6	0.8

Notes: (1) Heavy: As on main business street
Medium: As on secondary business streets
Light: As on local streets
(2) Night hour flow in both directions

TABLE 2 ADJUSTMENT FACTORS FOR RECOMMENDED AVERAGE ILLUMINATION VALUES

Surface Reflectance	Adjustment Factors
3 % or less	1.5
10%	1.0
20% or more	0.75

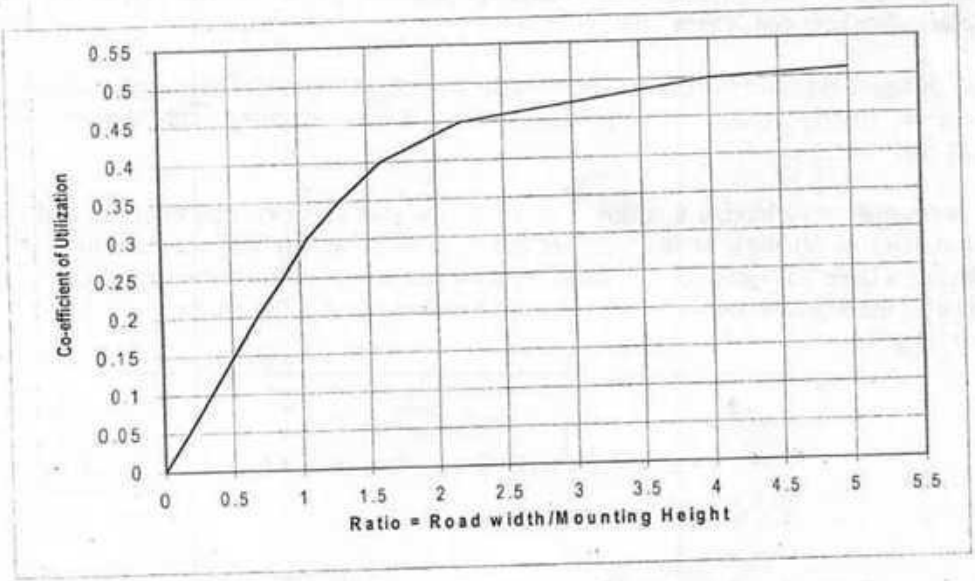
TABLE 3 LIGHTING SOURCE CHARACTERISTICS

Source Types	Expected Life (hrs)	Lighting Efficiency (Lumens/Watt)	Wattage (Watt)
Tungsten	1000	8 – 14	Up to 1000
Fluorescent	6000	50 – 75	Up to 250
Sodium	6000	100 – 120	Up to 160
Mercury	7500	20 – 60	Up to 400

TABLE 4 RECOMMENDED ARRANGEMENT OF STREET LIGHTING

Type of Arrangement	Pavement Width
One side	Width <= 30ft
Both sides – Staggered	30ft > Width <= 60ft
Both sides – Opposite	Width > 60ft

FIGURE 1 CO-EFFICIENT OF UTILIZATION CURVES (FOR LIGHT DISTRIBUTION TYPE III)



Note: Due to poor maintenance, the actual co-efficient of utilization is reduced by a factor usually 0.8 (i.e. taken as 80%).

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course title: Open Channel Flow — Course code: CE 361

Time: 3 hours — Total Marks: 150

Answer any **SIX** from the following questions. Each question has **25** marks.

The figures in the right margin indicate full marks.

1. (a) What is a lined channel? What are the reasons for lining a channel? 5

   (b) Show that the best hydraulic rectangular section is one half of a square. 4

   (c) Compute the wetted perimeter of the best hydraulic section for a lined channel to carry a discharge of 15 m^3/s with n=0.013 and S_0= 0.001 if the section is i) rectangular, ii) trapezoidal and iii) circular. Which section has the minimum wetted perimeter? 12

   (d) Differentiate between 'maximum permissible velocity' and 'non-silting velocity'. 4

2. (a) A lined channel (n=0.015) is to be laid on a slope of 1 in 2000. The side slope of the channel is to be maintained at 1.5 (H):1(V). Determine the depth of flow of a triangular section with rounded corner to carry a discharge of 40 m^3/s. 8

   (b) An erodible channel has to carry a discharge of 30 m^3/s through a coarse non-cohesive material having d_{75}= 3 cm and n= 0.025. It is to be laid on a slope of 1 in 1000 and is to be excavated in earth containing slightly rounded coarse non-cohesive particles. Determine the channel dimensions using the method by Lane. 12

   (c) Define the following terms: 5

   i. Critical shear stress ii. Angle of repose

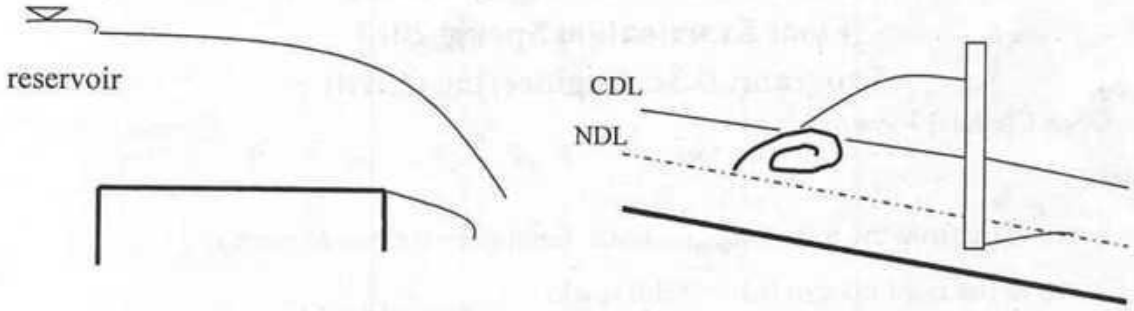
3. (a) Derive the following equation for gradually varied flow in an open prismatic channel. State the assumptions you made to derive the equation. 8

$$\frac{dy}{dx} = \frac{S_o - S_f}{1 - Fr^2}$$

   (b) A rectangular channel 7 m wide has three reaches arranged serially. The bottom slopes of the reaches are 0.0016, 0.015 and 0.0064. The 'n' values for the middle reach is 0.015 and for the others is 0.025. For a discharge of 20 m^3/s, sketch the resulting flow profiles. 10

   (c) Sketch the possible flow profiles produced on a critical slope and a horizontal slope. 7

4. (a) Define a control section. Locate control sections in the following two flow profiles. 4



(b) Sketch the possible water surface profiles in the following cases: 9

i. Mild --- Steep----Milder Steep --- Free Overfall
ii. Mild --- Steeper Mild ---Steep

(c) A rectangular channel having bottom width b=6m, n=0.025 and channel slope S_o=0.0025 carries a discharge of 40 m^3/s. At a section *A* of this channel the depth of flow is 2m. How far upstream or downstream from this section will the depth be 2.25 m? Use the direct step method (use three steps). 12

5. (a) List the characteristics of Rapidly Varied Flows. 4

(b) For a hydraulic jump on a horizontal, rectangular channel, derive the following expression of the sequent depth ratio. 6

$$\frac{y2}{y1} = \frac{1}{2}\left(\sqrt{1 + 8Fr_1^2} - 1\right)$$

(c)Water flows at a velocity of 6.1 m/s and a depth of 1m in a horizontal rectangular channel that is 6.1m wide. Find 15

a. The downstream depth necessary for hydraulic jump
b. The type of jump
c. The height of jump
d. Length of jump
e. Efficiency of the jump

6. (a) Differentiate between different types of hydraulic jumps based on Froude number. 8

(b) Water flows at a depth of 1m in a horizontal trapezoidal channel having a base width 6 m and side slope s=2. The discharge is 120 m^3/s. If a hydraulic jump occurs in this channel, compute the downstream depth that will create a hydraulic jump. 12

(c) Briefly describe a 'Stilling Basin'. Use a sketch to show different components of a 'Stilling Basin'. 5

7. (a) '*A hydraulic jump occurs on a channel comprises of a sloping bed and a horizontal bed. Whether the jump will take place on the sloping part or the horizontal part depends on the tailwater condition*'. Do you agree with this statement? Justify your answer. 6

(b) A rectangular channel is 1 m wide, and inclined at an angle of 3.5 degree with the horizontal. The channel carries a discharge of 0.15 m^3/s at an initial depth of flow section (d_1) 0.02 m and the tailwater depth is 0.7 m. If a hydraulic jump occurs in this channel, compute the sequent depth. 12

(c) Prove that for critical flow condition in a rectangular channel,

E_c (specific energy) = 1.5*y_c (critical depth) 7

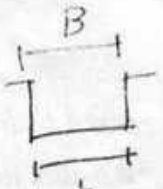
8. (a) A rectangular channel has a bottom width of 4.5 m. Construct the specific energy curve (use a graph paper) for Q= 12 m^3/s and determine the critical depth and minimum specific energy. 6

(b) A rectangular channel 2.5 m wide carries 6 m^3/s of flow at a depth of 0.5 m. Calculate the height of a flat topped hump required to be placed at a section to cause critical flow. The energy loss due to the obstruction by the hump is 0.1 times the upstream velocity head. 12

(c) Using the 'Specific Energy' equation [$E = y + Q^2/(2gA^2)$], prove that critical flow condition corresponds to the condition for maximum discharge in a channel for a fixed specific energy. 7

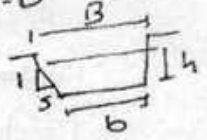
FORMULAE

1. $A = bh$; $P = b + 2h$; $B = b$



2. $A = (b + sh)h$; $P = b + 2\sqrt{1+s^2}\,h$

$B = b + 2sh$;

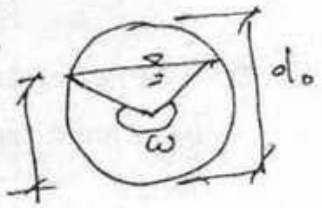


3. $A = sh^2$; $P = (2\sqrt{1+s^2}) * h$; $B = 2sh$

4. $h = d_o\left[1 - \cos\left(\frac{\omega}{2}\right)\right]/2$

$A = (\omega - \sin\omega)\, d_o^2/8$

$P = \omega d_o/2$



5. $Q^2/g = \frac{A_c^3}{B_c}$; $\frac{\alpha Q}{g} = \frac{A_c^3}{B_c}$ (when $\alpha \neq 1.0$)

6. $h_f = f\frac{L}{D}\frac{V^2}{2g}$; $n = \frac{d_{50}^{1/6}}{21.1}$ (d in meters)

7. $Re = \frac{VD}{\nu}$

8. $C = \sqrt{8g/f}$

9. $C = \frac{1}{n} R^{1/6}$

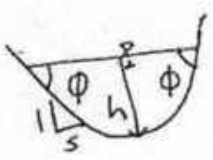
10. $\tau_o = \gamma R S_o$

11. $u_* = \sqrt{\frac{\tau_o}{\rho}} = \sqrt{gRS_o}$

12. $\delta_v = \frac{11.6\,\nu}{u_*}$

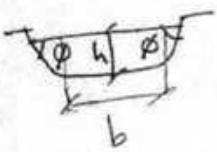
13. $A = h^2(\phi + \cot\phi)$

$P = 2h(\phi + \cot\phi)$



14. $A = bh + h^2(\phi + \cot\phi)$

$P = b + 2h(\phi + \cot\phi)$



15. Best hydraulic Sections

	A	P	B	D
Rectangle	$2h^2$	$4h$	$2h$	h
Triangle	h^2	$2\sqrt{2}h$	$2h$	$h/2$
Trapezoid	$\sqrt{3}h^2$	$2\sqrt{3}h$	$4\sqrt{3}h/3$	$3h/4$
Circle	$\pi h^2/2$	πh	$2h$	$\pi h/4$

16. For a trapezoidal best hydraulic section:

$$A = \left(2\sqrt{1+s^2} - s\right)h^2$$

$$b = 2\left(\sqrt{1+s^2} - s\right)h$$

$$P = 2h\left(\left(\sqrt{1+s^2}\right)*2 - s\right)$$

17. Erodible channel:

$$\Rightarrow \tau_0 = \gamma R S_0.$$

$$\Rightarrow K = \frac{\tau_s}{\tau_b} = \sqrt{1 - \frac{\sin^2\phi}{\sin^2\varphi}}$$

where φ = angle of repose

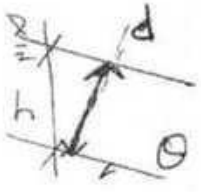
ϕ = sideslope angle.

$\Rightarrow$ permissible shear stress = $0.4 d_{75}$ (d_{75} in inches)

$$\Rightarrow \bar{S_f} = (S_{f_1} + S_{f_2})/2$$

$$\Rightarrow x_2 = x_1 + \frac{E_2 - E_1}{S_0 - \bar{S_f}}$$

18. $\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+2G_1^2} - 1\right)$



19. $G_1^2 = K_1^2 Fr_1^2$ where $K_1 = 10^{0.027\theta}$ (θ is in deg)

21. $\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+8Fr_1^2} - 1\right)$

or, $\frac{y_1}{y_2} = \frac{1}{2}\left(\sqrt{1+8Fr_2^2} - 1\right)$

Horizontal rectangular channel

22. $h_L = \frac{(y_2 - y_1)^3}{4y_1y_2}$

23. $\frac{L_j'}{y_1} = 9.75\,(Fr_1 - 1)^{1.01}$

24. $\frac{E_2}{E_1} = \frac{\left(1+8Fr_1^2\right)^{3/2} - 4Fr_1^2 + 1}{8Fr_1^2\,(2+Fr_1^2)}$

25. $\frac{h_3 \text{ (submerged)}}{h_t \text{ (tailwater)}} = \left[1 + 2Fr_1^2\left(1 - \frac{h_t}{h_g}\right)\right]^{1/2}$

26. $Fr^2 = \frac{Q^2 B}{gA^3}$

$Fr = 1$ (critical flow cond^n)

27. $\bar{z}$ for different sections

Rectangle – $h/2$

triangle – $h/3$

trapezoid – $\frac{h}{6}\left(\frac{3b + 2sh}{b + sh}\right)$

28. Specific force $F = \frac{Q^2}{gA} + \bar{z}A$

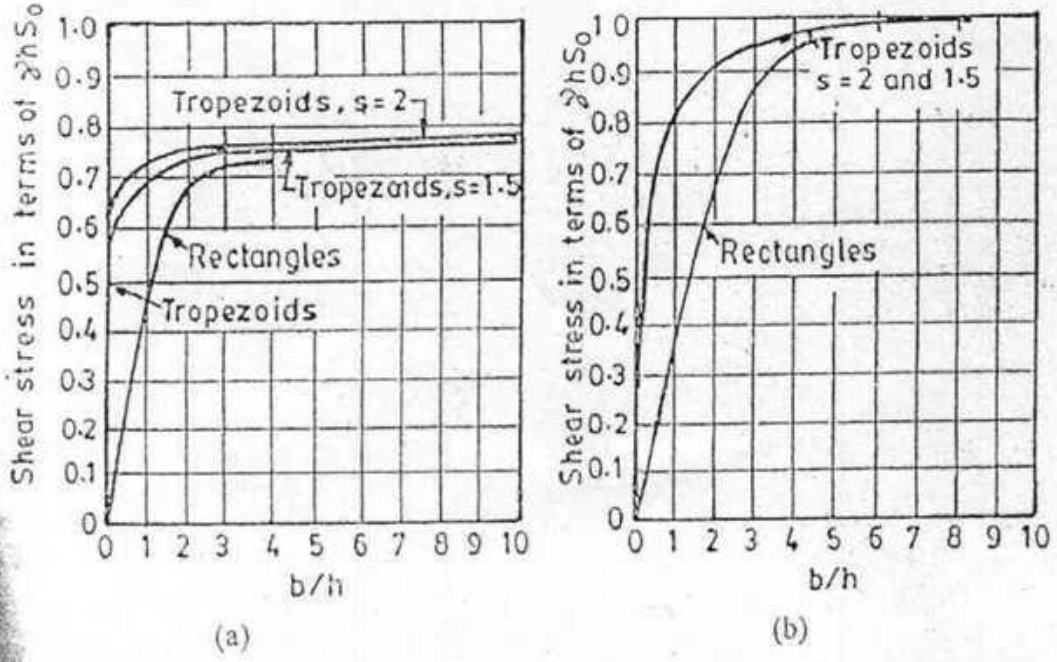
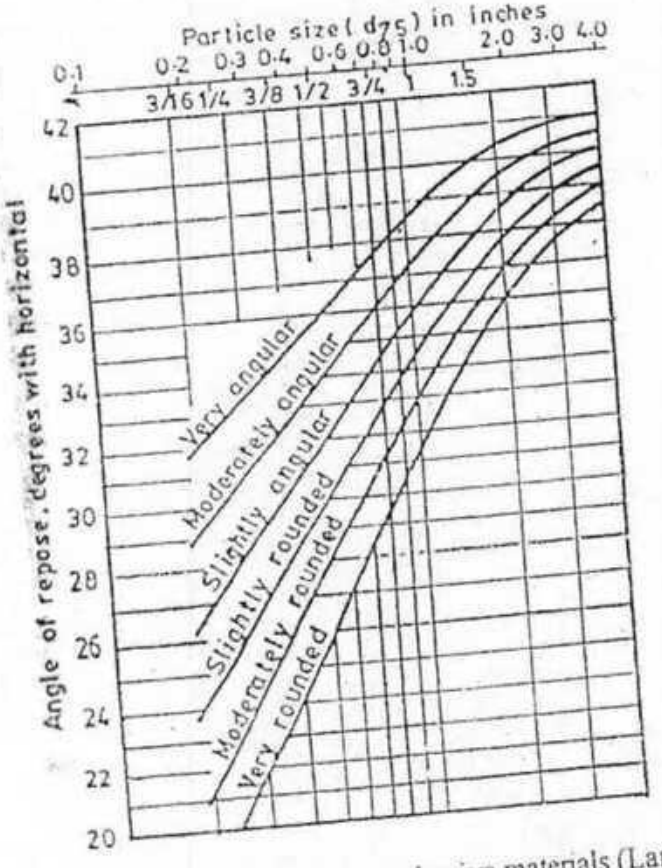


Fig. 5. 4 Maximum shear stresses on (a) sides and (b) bottom of trapezoidal channels

Stress Ratio



.6 Angle of repose of non-cohesive materials (Lane, 1955)

of the sediment particle. The

University of Asia Pacific

Department of Civil Engineering

Final Examination Spring,2013

Program: B.Sc. Engineering (Civil)

Course title: Engineering Hydrology **(SECTION A)** Course code: CE 363

Time: 3 hours Total Marks: 150

Use Two Separate Answer Scripts for Section I and Section II

Section I

Answer any **FOUR** from the following questions: (4 x 25=100)

1. (a) Differentiate between the following (5)
   i) Float gauge stage recorder and Bubble gauge stage recorder
   ii) Vertical axis current meter and Horizontal axis current meter

   (b) The following data were collected for a 24m wide stream at a gauging station. Compute the discharge. (15)

Distance from left water Water edge (m)	Depth, d(m)	Revolution of current meter at 0.6d below water surface REV	Duration of Observation SEC
0	0	0	0
2	0.5	80	180
4	1.1	83	120
6	1.95	131	120
9	2.25	139	120
12	1.85	121	120
15	1.75	114	120
18	1.65	109	120
20	1.50	92	120
22	1.25	85	120
23	0.75	70	150
24	0	0	0

Calibration equation of current meter: $v = 0.32N + 0.032$, N = revolutions per seconds, v = velocity, m/s.

(c) List different types of streamflow measurement techniques (at least five). (5)

2. (a) Define the following terms: (5)

   i. Normal precipitation ii. Return period iii. Double mass curve technique

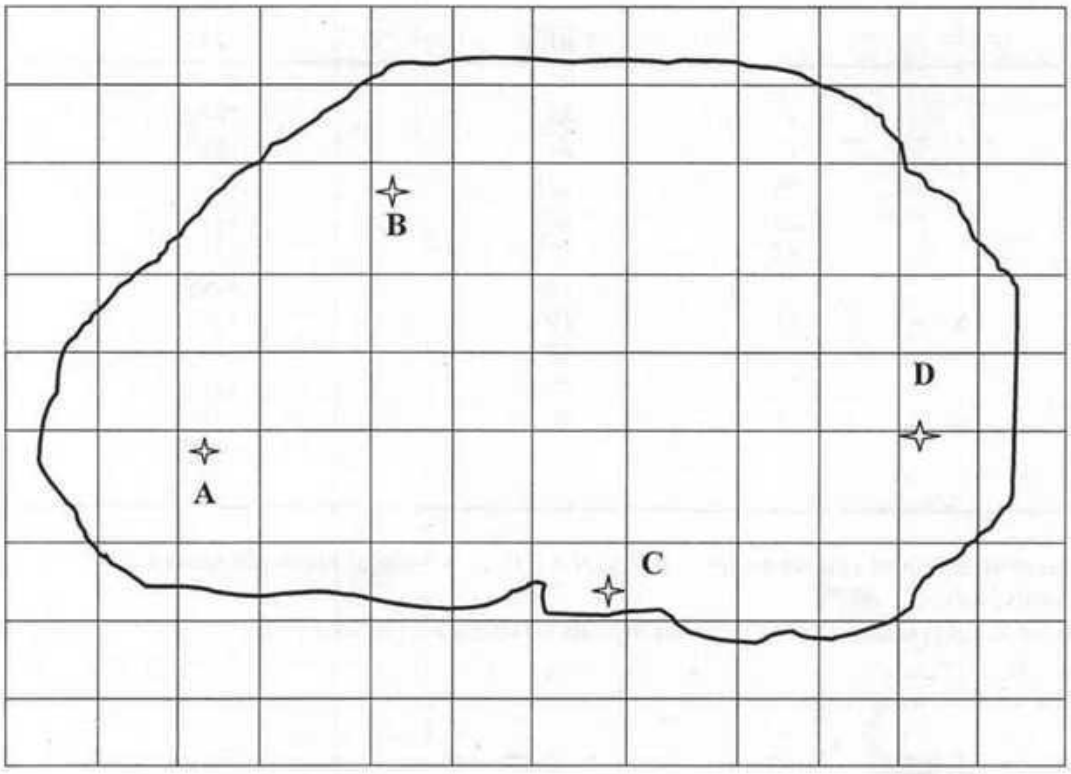
(b) Annual rainfall depth data are available below (Table 1) for three consistent gauges (A, B, C) and one inconsistent gauge D. Gauge D was relocated at the end of 1993. Therefore rainfall data for gauge D for the period 1991-1993 must be adjusted to the rainfall characteristics at the new location. Find the adjusted values (use graph paper). (20)

Table 1

Year	Annual rainfall (in)			
	A	B	C	D
1991	22	26	23	28
1992	21	26	25	33
1993	27	31	28	38
1994	25	29	29	31
1995	19	22	23	24
1996	24	25	26	28
1997	17	19	20	22
1998	21	22	23	26

3. (a). In a catchment area (shown below), four rainfall stations are situated inside the catchment. Given are the annual precipitation recorded by the four stations in 2010: A = 130.2 cm, B= 145cm, C=112cm and D= 100cm. Determine the average annual precipitation by the Thiessen polygon method. Consider each square as 1 sq km. (16)

(Attach this page with Answer Script, if you answer this question)



(b) Briefly describe two methods that are used to estimate missing rainfall data. (4)

(c) Provide short description on i) Moving boat method ii) Tipping bucket rain gauge (5)

4. (a) A drainage basin comprising five subcatchments is shown in the following figure. Determine the pipe diameters for AB, BC and DB for a five year return period storm. The area, runoff coefficients, and inlet time for each subcatchments are given in Table 1.0. The length and slope for each pipe is also given in the Table 2. The design precipitation intensity for this catchment is given by

$$i = 120\ T^{0.175} / (t_d + 27)$$

where i is in in/hr, T is return period, and t_d is duration in minutes. Assume n= 0.015. (20)

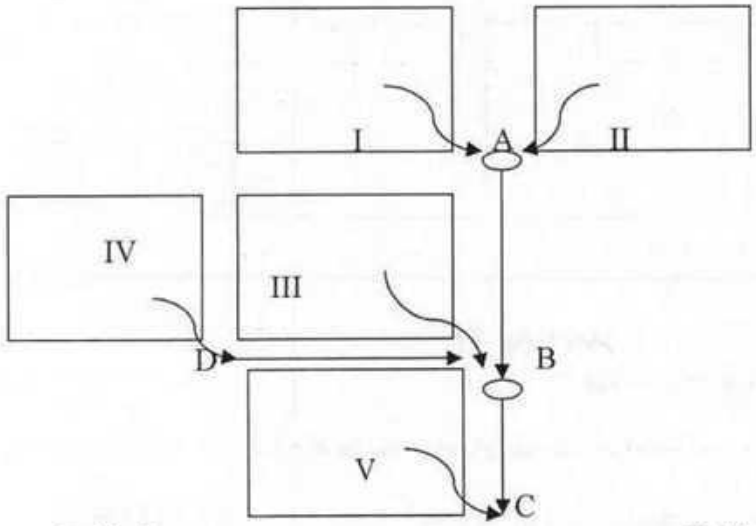


Table 1

catchment	Area A(ac)	Runoff coeff C	Inlet time (min)
I	2	0.7	5
II	3	0.7	7
III	4	0.6	10
IV	5	0.5	15
V	4.5	0.5	15

Table 2

Pipe name	Length (ft)	Slope (ft/ft)
AB	550	0.0081
BC	400	0.0064
DB	450	0.0064

(b) Define 'Stormwater modeling' in your own words. What are the uses of a 'stormwater model'? (5)

5. (a) Explain the following (10)

i) Aerodynamic Method for estimating Evaporation
ii) Pan-coefficient
iii) Horton's method of calculating infiltration capacity

(b) The evaporation from a lake is to be calculated by the water balance method. Inflow to the lake occurs through three small rivers A, B and C. The outflow occurs through river D. Calculate the evaporation from the lake surface during summer (May to August) if the water level was at elevation +571.04m on May 1 and +571.10 on August 31. The lake surface area is 100 sq. km. The precipitation P during the period was 100 mm. Average inflows and outflows are given below: (15)

River	Catchment (sq km)	Q average (m3/s)
A	150	15
B	120	11
C	121	17
D		45

6. (a) Distinguish between the following (9)
   i) Actual and potential evaporation
   ii) Field capacity and wilting point
   iii) Φ-index and W-index

(b) Discuss about the following weather systems for precipitation (provide sketch):
Orographic, Convective and Frontal. (7)

(c) A storm with 15 cm precipitation produced a direct runoff of 8.7 cm. The time distribution of the storm is as follows. Estimate the φ-index of the storm. (9)

Time from start (hr)	1	2	3	4	5	6	7	8
Incremental rainfall (cm)	0.6	1.35	2.25	3.45	2.7	2.4	1.5	0.75

Section-II

Answer any **TWO** from the following questions (2x25= 50)

7. (a) What are the factors need to be considered to choose a particular method to estimate the magnitude of flood peak. (3)

(b) The flood magnitudes of a river for return period of 50 and 100 years are 1100 and 1300 m^3/s respectively. These were found based on 30 years of data using Gumble method. (22)

   i) Determine the mean and standard deviation of the data used.
   ii) Estimate the magnitude of a flood with a return period of 500 years.
   iii) What are the (a) 80% (b) 95% confidence limits for the estimate in (ii)?

8. (a) Define Prism and Wedge storage with sketch. (5)

(b) The inflow and outflow hydrographs for a reach of a river is given below. Determine the best values of the Muskingum coefficients 'k' and 'x' for the reach. (20)

Time (hr)	0	3	6	9	12	15	18	21	24	27
Inflow (cumec)	20	60	80	210	240	215	170	90	40	16
Outflow (cumec)	20	30	50	150	225	220	185	120	85	23

9. (a) A basin has 400 km^2 of area ,L=35 km and L_{ca}=10 km. Assuming C_t=1.5 and C_p=0.7, develop a 3-hr unit hydrograph for this basin using Snyder's method. (10)

(b) Using the 12-hr unit hydrograph given below, compute the ordinates of a 3-hr unit hydrograph. (15)

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66	72
Ordinate of 12-hr unit hydrograph (m^3/s)	0	10	37	76	111	136	150	153	146	130	114	70	30

CE 363 - FORMULAE

$$Q = \sum_{i=1}^{N-1} \Delta Q_i \qquad \Delta A_1 = \overline{W}_1 y_1$$

$$\Delta Q_i = y_i \times \left(\frac{W_i}{2} + \frac{W_{i+1}}{2} \right) \times v_i \qquad \text{for } i = 2 \text{ to } (N-2)$$

where $$\overline{W}_1 = \frac{\left(W_1 + \frac{W_2}{2} \right)^2}{2 W_1}$$

and $$\Delta A_N = \overline{W}_{N-1} y_{N-1}$$

where $$\overline{W}_{N-1} = \frac{\left(W_N + \frac{W_{N-1}}{2} \right)^2}{2 W_N}$$

to get

$$\Delta Q_1 = \overline{v}_1 . \Delta A_1 \quad \text{and} \quad \Delta Q_{N-1} = \overline{v}_{N-1} \Delta A_{N-1}$$

$Q = (1.49/n)\, S^{0.5} AR^{2/3}$ in fps system

$Q = (1/n)\, S^{0.5} AR^{2/3}$ in SI system

$Q = C\, i\, A$

c in per cent	50	68	80	90	95	99
$f(c)$	0.674	1.00	1.282	1.645	1.96	2.58

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 Spring 2013

Program: B.Sc. Engineering (Civil)

Course title: Engineering Hydrology **(SECTION A)** Course code: CE 363

Time: 3 hours Total Marks: 150

Section-II

Answer any **TWO** from the following questions (2x25= 50)

7. (a) What are the factors need to be considered to choose a particular method to estimate the magnitude of flood peak. (3)

(b) The flood magnitudes of a river for return period of 50 and 100 years are 1100 and 1300 m^3/s respectively. These were found based on 30 years of data using Gumble method. (22)

i) Determine the mean and standard deviation of the data used.
ii) Estimate the magnitude of a flood with a return period of 500 years.
iii) What are the (a) 80% (b) 95% confidence limits for the estimate in (ii)?

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

b) Describe the factors affecting a flood hydrograph. (8)

c) Write short notes on the following (3x3=9)

i) Effective rainfall
ii) Unit Hydrograph
iii) Confidence limit

9. (a) A basin has 400 km^2 of area ,L=35 km and L_{ca}=10 km. Assuming C_t=1.5 and C_p=0.7, develop a 3-hr unit hydrograph for this basin using Snyder's method. (10)

(b) Using the 12-hr unit hydrograph given below, compute the ordinates of a 3-hr unit hydrograph. (15)

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66	72
Ordinate of 12-hr unit hydrograph (m^3/s)	0	10	37	76	111	136	150	153	146	130	114	70	30

University of Asia Pacific

Department of Civil Engineering

Final Examination Spring 2013

Program: B.Sc. Engineering (Civil)

Course title: Engineering Hydrology **(SECTION B)** Course code: CE 363

Time: 3 hours Total Marks: 150

Use Two Separate Answer Scripts for Section I and Section II

Section I

Answer any **TWO** from the following questions: 25 x 2 = 50

1. (a) Differentiate between the following (5)
   i) Float gauge stage recorder and Bubble gauge stage recorder
   ii) Vertical axis current meter and Horizontal axis current meter

   (b) The following data were collected for a 24m wide stream at a gauging station. Compute the discharge. (15)

Distance from left water Water edge (m)	depth, d	Revolution of current meter at 0.6d below water surface REV	Duration of observation SEC
0	0	0	0
2	0.5	80	180
4	1.1	83	120
6	1.95	131	120
9	2.25	139	120
12	1.85	121	120
15	1.75	114	120
18	1.65	109	120
20	1.50	92	120
22	1.25	85	120
23	0.75	70	150
24	0	0	0

Calibration equation of current meter: $v = 0.32N + 0.032$, N = revolutions per seconds, v = velocity, m/s.

(c) List different types of streamflow measurement techniques (at least five). (5)

2. (a) Define the following terms: (5)
   i. Normal precipitation ii. Return period iii. Double mass curve technique

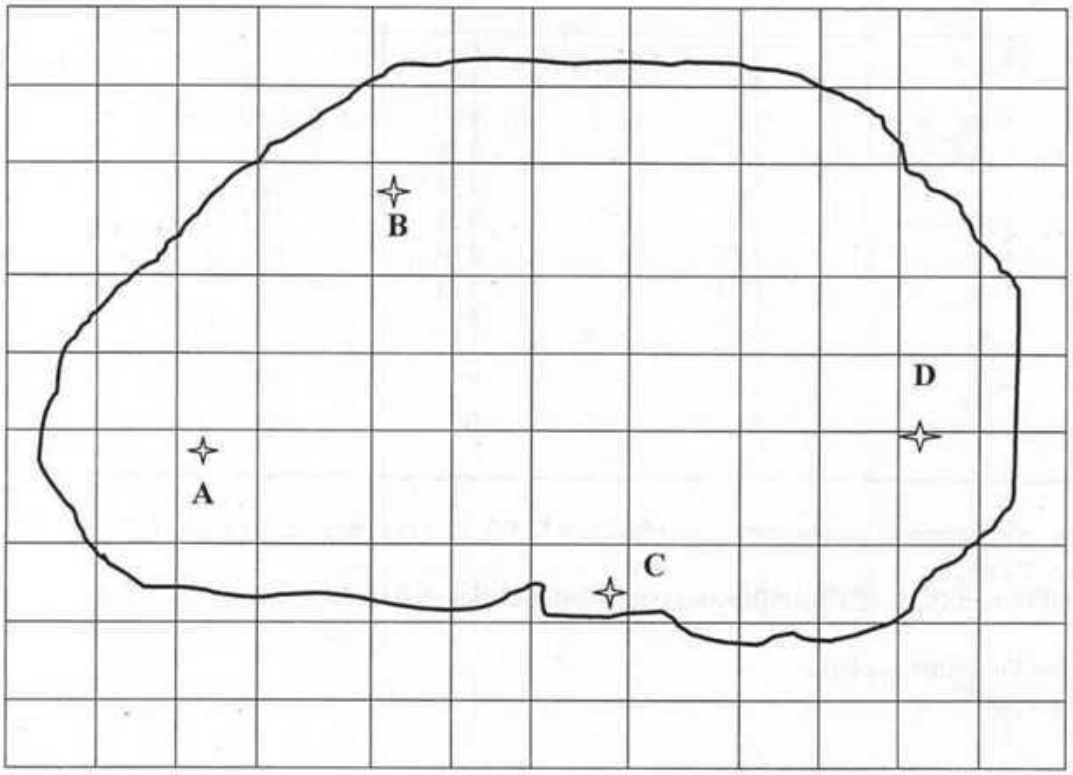
(b) Annual rainfall depth data are available below (Table 1) for three consistent gauges (A, B, C) and one inconsistent gauge D. Gauge D was relocated at the end of 1993. Therefore rainfall data for gauge D for the period 1991-1993 must be adjusted to the rainfall characteristics at the new location. Find the adjusted values (use graph paper). (20)

Table 1

Year	Annual rainfall (in)			
	A	B	C	D
1991	22	26	23	28
1992	21	26	25	33
1993	27	31	28	38
1994	25	29	29	31
1995	19	22	23	24
1996	24	25	26	28
1997	17	19	20	22
1998	21	22	23	26

3. (a). In a catchment area (shown below), four rainfall stations are situated inside the catchment. Given are the annual precipitation recorded by the four stations in 2010: A = 130.2 cm, B= 145cm, C=112cm and D= 100cm. Determine the average annual precipitation by the Thiessen polygon method. Consider each square as 1 sq km. (16)

(Attach this page with Answer Script, if you answer this question)



(b) Briefly describe two methods that are used to estimate missing rainfall data. (4)

(c) Provide short description on i) Moving boat method ii) Tipping bucket rain gauge (5)

Section-II

Answer any **FOUR** from the following questions: (4x25=100)

4. a) What factors need to be considered to choose a particular method to estimate the flood peak magnitude? (5)

b) The flood magnitudes of a river for return period of 50 and 100 years are 1100 and 1300 m^3/s respectively. These were found based on 30 years of data using Gumble method. (20)

i) Determine the mean and standard deviation of the data used.

ii) Estimate the magnitude of a flood with a return period of 500 years.

iii) What are the (a) 80% (b) 95% confidence limits for the estimate in (ii)?

5. a) Define 'Prism Storage' and 'Wedge storage' with sketch. (5)

b) The inflow hydrograph for a channel reach are given below, for which the Muskingum coefficient k= 2.3 hr, x= 0.15 and Δt=1 hr. Route the flood through the reach and determine the attenuation and time lag of outflow. The initial outflow is 85 ft^3/s. (20)

Time (hr)	0	1	2	3	4	5	6	7	8	9	10
Inflow (cfs)	85	93	137	208	320	442	546	630	676	691	675

Time (hr)	11	12	13	14	15	16	17	18	19	20
Inflow (cfs)	675	634	571	477	329	247	184	134	108	90

6. a) Define synthetic hydrograph. Explain the procedure of deriving a synthetic unit hydrograph for a catchment by using Snyder's method. (10)

b) Rainfall of magnitude 3.8 cm and 2.8 cm occurring in two consecutive 6-h duration on a catchment of area 30km^2 produced the following hydrograph. Estimate the rainfall excess and φ index. (15)

Time from start of rainfall (h)	-6	0	6	12	18	24	30	36	42	48	54
Observed flow (m^3/s)	8	7	15	28	23	18	14	11	5	4.5	4.5

7. a) A basin has 400 km^2 of area , L=35 km and L_{ca}=10 km. Assuming C_t=1.5 and C_p=0.7, develop a 3-hr unit hydrograph for this basin using Snyder's method. (10)

b) Using the 12-hr unit hydrograph given below, compute the ordinates of a 3-hr unit hydrograph. (15)

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66	72
Ordinate of 12-hr unit hydrograph (m^3/s)	0	10	37	76	111	136	150	153	146	130	114	70	30

8. a) A reservoir has the following elevation, discharge and storage relationships: (25)

Elevation (m)	Storage ($10^6 m^3$)	Outflow discharge (m^3/s)
100.00	3.350	0
100.50	3.472	10
101.00	3.380	26
101.50	4.383	46
102.00	4.882	72
102.50	5.370	100
102.75	5.527	116
103.00	5.856	130

When the reservoir level was at 100.50 m the following flood hydrograph entered the reservoir.

Time (h)	0	6	12	18	24	30	36	42	48
Discharge (m^3/s)	10	20	55	80	65	50	30	20	11

Route the flood and obtain the outflow hydrograph.

9. a) What are the different alternative methods to estimate the magnitude of a flood peak? Explain the rational method of computing the peak discharge. (8)
b) Describe the factors affecting a flood hydrograph. (8)
c) Write short notes on the following (3x3=9)
   i) Effective rainfall
   ii) Unit Hydrograph
   iii) Confidence limit

CE 363 - FORMULAE

$$Q = \sum_{i=1}^{N-1} \Delta Q_i \qquad \Delta A_1 = \overline{W}_1 y_1$$

$$\Delta Q_i = y_i \times \left(\frac{W_i}{2} + \frac{W_{i+1}}{2} \right) \times v_i \qquad \text{for } i = 2 \text{ to } (N-2)$$

where $$\overline{W}_1 = \frac{\left(W_1 + \frac{W_2}{2} \right)^2}{2 W_1}$$

and $$\Delta A_N = \overline{W}_{N-1} y_{N-1}$$

where $$\overline{W}_{N-1} = \frac{\left(W_N + \frac{W_{N-1}}{2} \right)^2}{2 W_N}$$

to get

$$\Delta Q_1 = \overline{v}_1 . \Delta A_1 \quad \text{and} \quad \Delta Q_{N-1} = \overline{v}_{N-1} \Delta A_{N-1}$$

$Q = (1.49/n)\, S^{0.5} AR^{2/3}$ in fps system

$Q = (1/n)\, S^{0.5} AR^{2/3}$ in SI system

$Q = C\, i\, A$

c in per cent	50	68	80	90	95	99
$f(c)$	0.674	1.00	1.282	1.645	1.96	2.58

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 Spring 2013
Program : B. Sc. Engineering (Civil)

Course Title: Project Planning and Management — Course Code: CE 401
Time: 10:00 am 1:00 pm — Full Marks: 100

There are SEVEN Questions answer any FIVE
(Graph sheet and MRP sheet should be supplied)

1. (a) Discuss the importance of Customer Training and Lesson Learned Report at the delivery stage of a project. [5]

   (b) A transistor radio company manufactures models A, B, C which have profit contribution of Tk. 8, Tk. 15 and Tk. 25, respectively. The weekly minimum production requirements are 100 for model A, 150 for model B and 75 for model C. Each type of radio requires a certain amount of time for the manufacture of component parts, for assembling and for packaging. Specifically a dozen units of model A requires 3 hours for manufacturing, 4 hours for assembling and 1 hour for packaging. The corresponding figures for a dozen units of model B are 3, 5.5 and 1.5 and for a dozen units of model C are 5, 8 and 3. During the forthcoming week, the company was available for 150 hours of manufacturing, 200 hours of assembling and 60 hours of packaging time. Formulate this production scheduling problem as a Linear Programming model. [12]

   (c) What is redundant constraint in LP problem? [3]

2. (a) Objective function: [15]

   Maximize $Z = 2x_1 + 3x_2$

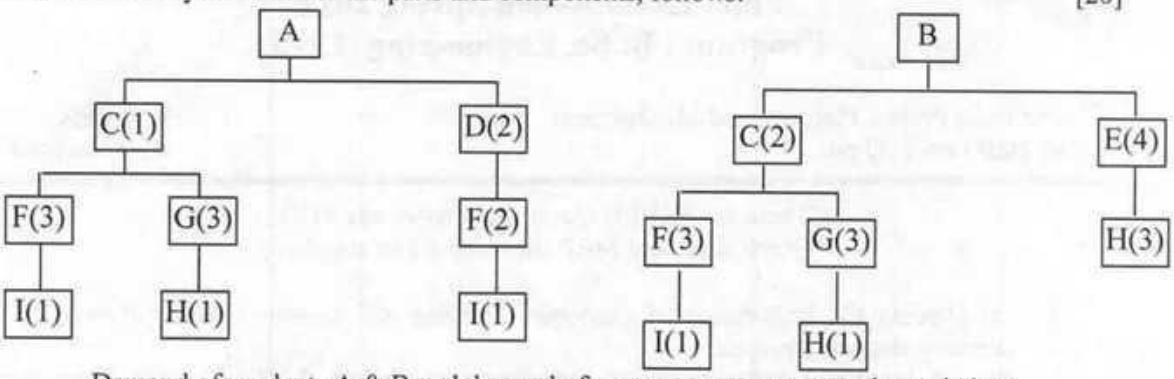
   Constraints:

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

   i. Find the optimum value of X_1 and X_2 by graphical method
   ii. Find maximum profit
   iii. Find the range of optimality for coefficient of X_1 and X_2 in the objective function.

   (b) Suppose MAD of your historical data is 5 and you found the forecast for the next period as 350. You have 10 units on-hand from the last period. How much do you need to produce for the next period? After the next period you again calculated the MAD with the new data and found MAD as 4 (suppose). Do you think that the demand should be higher than the forecast? Justify your answer. [5]

3. Brown and Brown Electronics manufacture 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. 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: [20]



Demand of products A & B and demand of spares 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	----	80	2
E	-----	380	100	1
F	-----	100	150	1
G	-----	-----	40	1
H	-----	-----	200	1
I	-----	-----	300	1

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

4. (a) There are following seven jobs and they must pass through Machine 1 and Machine 2, respectively. Operating time in weeks for both the machines are shown below for each of the job. [12]

Job	Operations Time for machine 1	Operations Time for machine 2
L	9	6
M	5	5
N	7	6
O	6	3
P	1	2
Q	2	6
R	4	6

i. Schedule (job sequence and show the arrangement in diagram for machine 1 & 2) the seven jobs through two machines in sequence 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 & 2, separately.

(b) Assign the tasks to the employees such that each employee will be assigned by only one job to minimize the total cost. Find at least two multiple solutions if there is any. [8]

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

5. (a) 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, the precedence relationships of the activities are as follows: [10]

Activity	Description	Activity Predecessor	Time (Weeks)
A	Position recruiting	-------	4
B	System development	A	3
C	System training	A	5
D	Equipment training	A	3
E	Manual system test	B,C	5
F	Preliminary system changeover	C	6
G	Computer-personal interface	D	5
H	Equipment –modification	E	4
I	Equipment testing	F,G	5
J	System debugging and installation	H,I	7

A. Draw the AON network diagram
B. Find the project completion time
C. Find the critical path
D. Find ES/EF and LS/LF for each of the activity
E. If you reduce the time required for activity D & E by 1 week each, find the project completion time and critical path as well.

(b) What are the types of inventory and inventory cost? Explain briefly with examples. [5]
(c) Discuss the project life cycle and different stages of a project in detail. [5]

6. (a) Annual Demand = 10,000 units [8]
Days per year considered in average daily demand = 365
Cost to place an order = $10
Holding cost per unit per month = 0.01% of cost per unit
Lead time = 3 days
Cost per unit = $15
Determine the economic order quantity and the reorder point. Also find the Annual Ordering and Holding cost. State some significance of the obtained results.

(b) The following tabulations are actual sales of units for six months and a starting forecast in January. [12]

	Actual	Forecast
January	100	80
February	94	
March	106	
April	80	
May	68	
June	94	

i. Calculate 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 compare to the most old data and 1.5 times more weight for the second recent data compare to the most old data)
iii. Using MAD, find the appropriate forecast method among the above two. Justify your answer.

7. (a) A dairy feed company may purchase and mix one or more of the three types of grains containing different amounts of nutritional elements. The data are given in the table below. The production manager specifies that any feed mix for his livestock must meet at least minimal nutritional requirements and seeks the least costly among all such mixes. Formulate for linear programming model. [8]

	Item	One unit weight of			Minimal Requirement
		Grain-1	Grain-2	Grain-3	
Nutritional ingredients	A	2	3	7	1250
	B	1	1	0	250
	C	5	3	0	900
	D	6	25	1	1232.5
Cost/unit weight (Tk)		41	35	96	

(b) What are the important characteristics of a project? [3]
(c) What are the different assumptions of Basic Fixed Order Quantity Model? [3]
(d) What are the qualitative forecasting methods? Discuss them briefly. [6]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Title: Professional Practices and Communication | Course Code: CE 403
Time: 120 minutes | Full Marks: (12½×8)=100

There are 9 questions. Answer any 8 (eight).

1. a. As per the"*Dhaka Imarat Nirman Bidhimala 2008*", what maximum four steps might be required for getting approvals of building design and usage? [2]
   b. Define FAR and Setback. [1+1]
   c. How much setback is required in front of a building on a 11 *katha* plot? [1½]
   d. As per *bidhimala,* what is "Front" of a building? [1]
   e. What are the criteria for considering a building large or special? [6]

2. a. What are the different steps needed for preparing effective oral presentation? [2½]
   b. What are the different ways of delivering an oral message? Briefly explain each. [2½]
   c. 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. [7½]

3. a. Explain Green Economy and Sustainable Development? [2+2]
   b. What are the three pillars of Sustainable Development? [1½]
   c. How does Green Economy contribute to Sustainable Development? [7]

4. a. Define Collective Bargaining. [2]
   b. What are the salient features of Collective Bargaining [4]
   c. Write down the objectives of Industrial Relationship. [6½]

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

6. a. When does a person may be referred as "unemployed"? [1½]
   b. Explain through equation that "steady state rate of unemployment depends on the rate of job separation and rate of job finding". Use the following notations:
      L = Total labor force, E = Number of employed labor force, U =Number of unemployed labor force, s = Rate of job separation, f=Rate of job finding [8]
   c. In what type of procurement 'Two Stage Tendering Method' is used? [3]

7. a. Mention two problems if there is no provision of Price Adjustment in agreement. [2]
   b. What are the conditions of applicability of PAF? [2]
   c. Explain the equation of PAF. [4]
   d. Contract price of reinforcement is Tk. 65,000 per ton and price of that at the time of execution (as per BBS) is Tk. 72,000 and the price 28 days before receiving tenders was Tk. 69000. What will be adjusted price of that item? Use usual value of coefficients. [4½]

8. a. Mention importance of communication in professional or business world. [2]
   b. When a communication is considered to be effective? [1½]

c. Explain the principles or "Seven C's" of effective written or oral communication. [9]

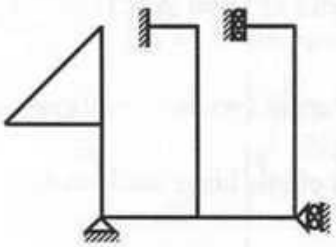
9. a. What is tender evaluation report? What are its contents? [2½]
   b. What are the steps for preparing and submitting tender document? [5]
   c. Write the differences between OTM and LTM? [5]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013 (Set 2)
Program: B. Sc. Engineering (Civil)

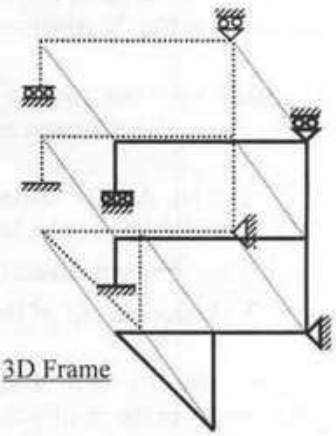
Course Title: Structural Engineering III Credit Hours: 3.0 Course Code: CE 411
Time: 3 hours Full Marks: 100 (= 10 × 10)

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

1. Determine the degree of kinematic indeterminacy (*doki*) and show the corresponding deflections and rotations of the 2D frame and 3D frame shown in Fig. 1
   (i) with and without considering the boundary conditions,
   (ii) if axial deformations are neglected.



2D Frame



3D Frame

Fig. 1

2. In the truss *abcdef* loaded as shown in Fig. 2
   (i) Justify that *ab*, *bc*, *cd*, *af*, *bf*, *cf* and *df* are zero-force members.
   (ii) Use Stiffness Method to calculate the deflections at joint *e*
   [Given: S_x = constant = 5000 kN/m].

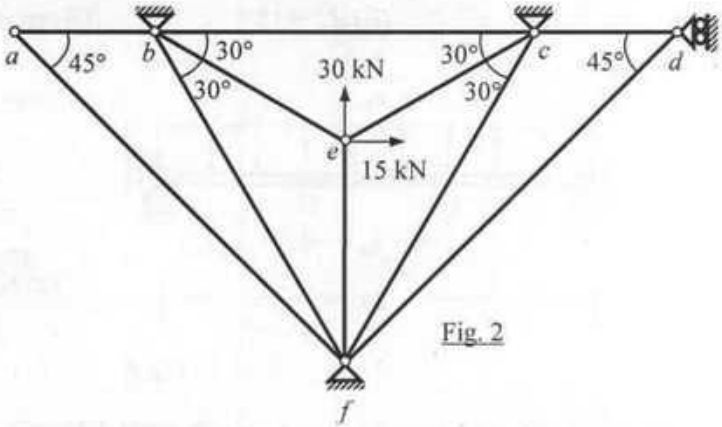
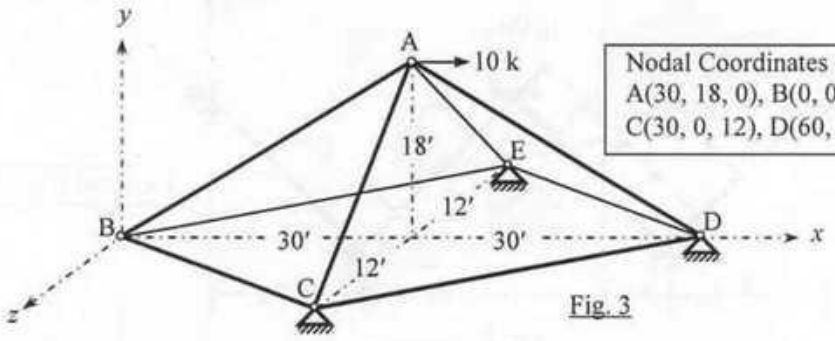


Fig. 2

3. Ignore zero-force members to form the stiffness matrix, load vector and write down the boundary conditions of the 3D truss ABCDE shown in Fig. 3 [Given: S_x = constant = 500 k/ft].



Nodal Coordinates (ft)
A(30, 18, 0), B(0, 0, 0),
C(30, 0, 12), D(60, 0, 0), E(30, 0, −12)

Fig. 3

4. Use Stiffness Method to calculate the deflection and rotation at joint *c* of the grid *abcd* shown in Fig. 4. The spring at *c* represents a circular foundation of radius 3-ft on the surface of sub-soil (half-space) with shear-wave velocity (v_s) equal to 300 ft/sec.

   The structure can be simplified by using symmetry about *ac*

   [Given: $EI = 60\times10^3$ k-ft^2, $GJ = 50\times10^3$ k-ft^2,
   Unit weight of soil = 0.11 k/ft^3, Poisson's ratio = 0.30].

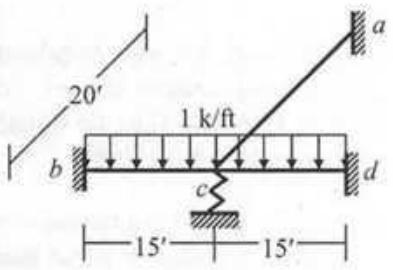


Fig. 4

5. Assemble the stiffness matrix, load vector and specify the boundary conditions of beam ABCD loaded as shown in Fig. 5, considering both axial and flexural deformations [Given: $E = 400 \times 10^3$ k/ft^2].

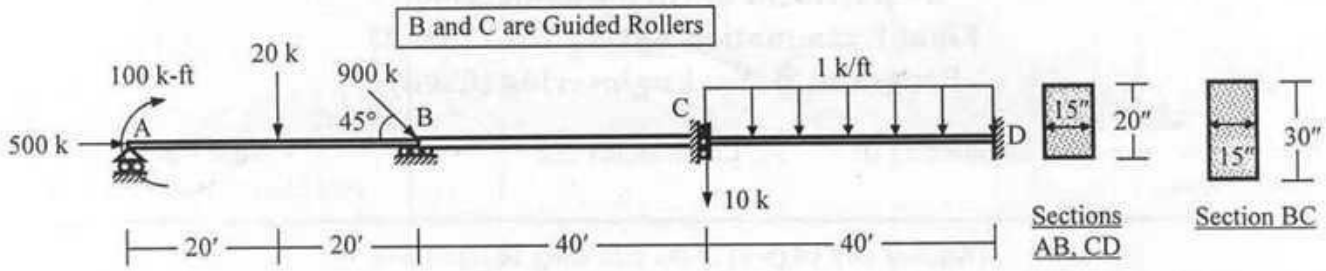


Fig. 5

6. Use Stiffness Method to calculate the unknown joint deflections and rotations of the beam ABCD loaded as shown in Fig. 5, considering flexural deformations only with geometric nonlinearity.

7. Consider axial deformations only to calculate the natural frequencies of beam ABCD shown in Fig. 5, using the consistent-mass matrix, if it made of a material with unit weight = 0.15 k/ft^3.

8. For the beam ABCD loaded as shown in Fig. 5, use the Energy Method (assuming collapse mechanism of AB and BCD) to calculate the required
   (i) Plastic moment capacity of the sections to prevent formation of plastic hinge mechanism,
   (ii) Yield strength (f_y) of the material.

9. Use bending moment diagram to calculate the distributed load w_0 required to develop plastic hinge mechanism in the reinforced concrete beam ABCD loaded as shown in Fig. 6 if
   (i) $L_0 = 5'$, (ii) $L_0 = 15'$ [Given: $f_c' = 3$ ksi, $f_y = 50$ ksi].

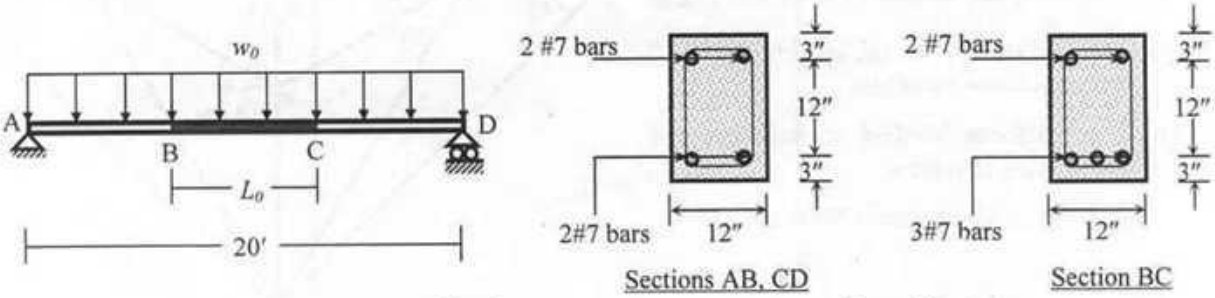


Fig. 6

10. Use Stiffness Method (considering flexural deformations, if $P = 0$) to calculate the rotation at node b and deflection at d of the frame $abcde$ loaded as shown in Fig. 7 [Given: EI = constant = 10×10^3 kN-m^2].

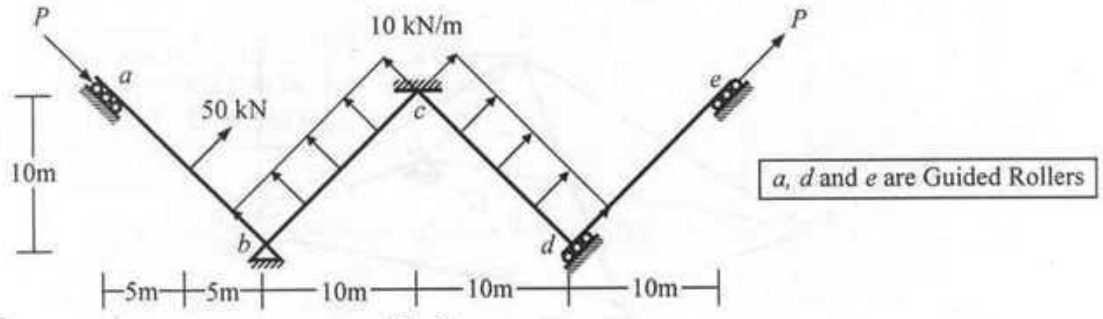


Fig. 7

11. Use Constant Average Acceleration (*CAA*) Method (considering flexural deformations only, if $P = 0$) to calculate the rotation at node b of the 5% damped frame $abcde$ shown in Fig. 7, at time $t = 0.01$ sec after starting from rest (i.e., no initial displacement and velocity), assuming consistent mass of the members, each weighing 8.0 kN/m.

12. Use Stiffness Method (considering flexural deformations with geometric nonlinearity) to calculate the
   (i) Force P needed to cause buckling of frame $abcde$ shown in Fig. 7 (considering members ab and bc),
   (ii) Deflection at joint d using the force P calculated in (i).

13. The 200-ft long cable *acb* shown in Fig. 8 (subjected to tension $P = 2000$ lb), carries a concentrated load of $F_0 = 100$ lb, in addition to a distributed self-weight $w_0 = 1$ lb/ft.

Assuming negligible value of $EI (\cong 0)$, consider geometric nonlinearity to calculate the

(i) Rotation at joint *b*,

(ii) Natural frequency of the cable.

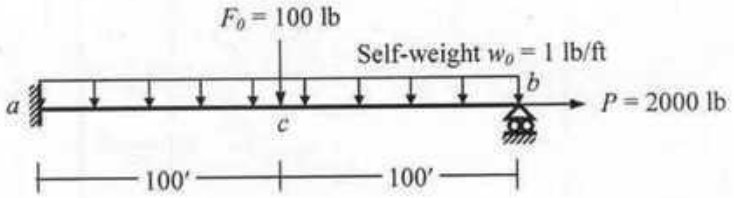


Fig. 8

14. Briefly explain the

(i) difference between the structural analysis of a 3D frame and grid (considering member properties, joint deflections/rotations and member forces),

(ii) possible effect of axial force on geometric nonlinearity and structural stiffness,

(iii) difference between beam mechanism and side-sway mechanism in the plastic analysis of frames,

(iv) possible effect of material nonlinearity on the natural frequency of a structure,

(v) effect of soil properties on the stiffness of foundation.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

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

(There are **SIX** Questions. **Answer any FOUR Questions)**

1. **(a)** A simply supported concrete beam of 12 m span is post tensioned with 820 mm^2 steel to a initial prestress of 1000 MPa. A concentrated load of 50 KN is applied at midspan immediately after prestressing. Compute the initial deflection at midspan due to prestress and beam's self weight. Cross section of the rectangular beam is of 300 mm width and 500 mm depth. c.g of cable is 150 mm from bottom at midspan and 300 mm from top at end of section. E_c= 30000 MPa. Also estimate the deflection after 3 months assuming creep factor of 2.0. Given that 18% Loss of prestress occur **(16)**

   (b) Draw three undesirable positions of cable profile(c.g.s zone limit). How the problem can be solved? **(5)**

   (c) Draw four layouts of tendons in simple prestressed concrete beam. **(4)**

2. A section of a simply supported composite beam of 20m span is shown in Figure 1. The precast stem is prestressed with an effective force of 1200 kN assuming a total loss as 20%. After this precast portion is erected in place, a top slab of 120 mm by 1000 mm wide is cast in place. After the slab concrete has hardened the composite section is to carry a uniformly distributed live load of 50 kN/m. Self weight of precast stem is 10kN/m. Moment at midspan due to top slab is 120 kN-m. Compute the stresses in the section at different stage of loading. Also draw the stress distribution at different stage of loading for the section. **(18+7)**

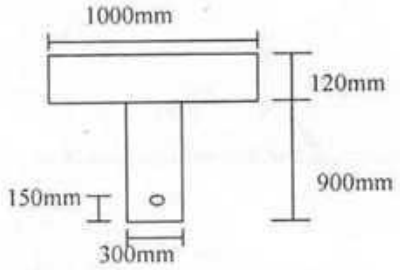


Figure 1

3. **(a)** Make a preliminary design for section of a prestressed concrete beam to resist a total moment of 480 kN-m including girder self weight moment of 70 kN-m. Assume a trial depth of $42\sqrt{(M_T)}$ in mm (where M_T is in kN-m). **(7)**

   Given: f_{se} = 850 MPa & f'_c = 28 MPa.

   (b) Make a final design for the preliminary section obtained from 3(a) for the following given data: **(18)**

   f'_{ci} = 35 MPa, f'_c= 28MPa, f_0 = 1050 MPa and tension is allowed in the section.

4. **(a)** Determine the ultimate moment capacity of the section (Figure 2) of a prestressed concrete system. Use $f'c = 38$ MPa, $E_{prestress} = 220000$ MPa, $E_c = 30000$ MPa , $f_{pu} = 1860$ MPa, $f_y = 415$ MPa and effective prestress $f_{se} = 1000$ MPa. $A_s = 1400$ mm^2. **(16)**

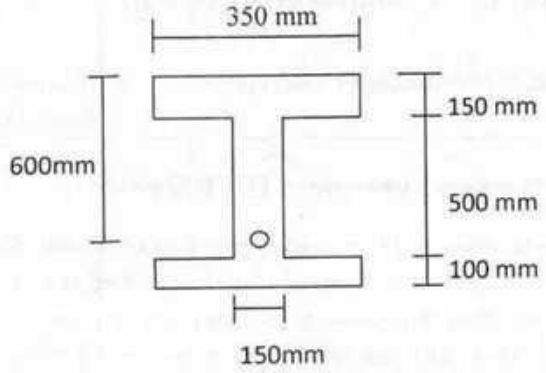


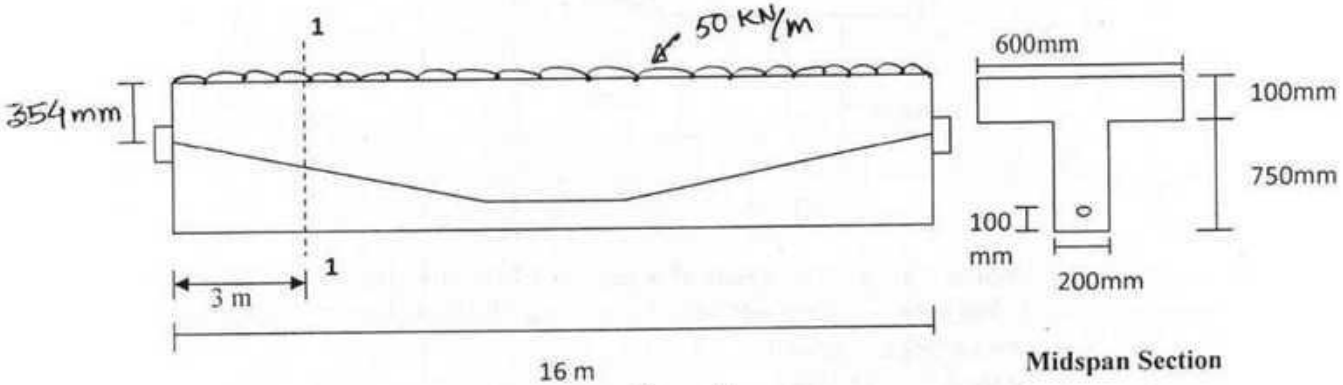
Figure 2

(b) Write the factors that affect the transfer length of prestressing steel? **(4)**

(c) Show the stress distribution in a prestressed concrete beam section for different location of compressive force 'C' with respect to kern points. **(5)**

5. **(a)** Why is the shear capacity of prestressed concrete beam higher than corresponding R.C beam? **(5)**

(b) Check shear strength of the beam shown in Figure 3 at section 1-1 which is at 3 m from the left support. Use both equation (web shear crack and inclined shear crack) for shear strength evalution. Effective prestress with 20% loss =1300 kN. Use $f'c = 40$ MPa, $A_s = 920$ mm^2. Self weight of beam is 6.5 kN/m. c.g of the T beam section is located at 354 mm below the top fiber. **(20)**



Midspan Section

Figure 3

Formula:

$f = -(F/A) \pm (Fey/I) \pm (My/I)$

$w_p = (\rho_p f_{ps}) / f'_c$

$f_{ps} = f_{pu} (1-0.5 \rho_p f_{pu} / f'_c)$

For rectangular beam , $M_u = \emptyset A_{ps} f_{ps} (d-a/2)$

For T beam , $M_u = \emptyset [A_{pw} f_{ps} (d-a/2) + 0.85 f'_c (b-b_w) h_f (d-h_f/2)$

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

Elastic design:

For $M_G / M_T < 0.2$;

$F = M_L / 0.5h$

$A_c = F / 0.5 f_c$

$e_1 + e_2 = (M_G + f'_t A k_b) / F_0$

$F = (M_T - f'_b A k_t) / a$

$a = k_1 + e_1 + e_2$

$A_c = (F_0 h)/(f_b c_t - f'_t c_b)$

$A_c = (Fh)/(f_t c_b - f'_b c_t)$

Shear Check:

Shear stress, $v_{cw} = 0.29\sqrt{f'_c} + 0.3 f_{pc} + V_p / b_w d$

Shear Stress, $v_{ci} = 0.05\sqrt{f'_c} + [V_d + (V_i M_{cr}/M_{max})/b_w d] > 0.14\sqrt{f'_c}$

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

$M_{max}/V_i = (Lx-x^2)/(L-2x)$

Bearing Plate :

At service load : $f_{cp} = 0.6 f'_c \sqrt{(A'_b/A_b)} < f'_c$

At transfer load : $f_{cp} = 0.8 f'_{ci} \sqrt{[(A'_b/A_b)-0.2]} < 1.25 f'_{ci}$

Moment of inertia of triangular section with respect to centroidal axis= $bh^3/36$

6. (a) Determine the bearing plate area required for the tendons shown in figure 4. Follow the specifications of the post tensioning institute for allowable bearing stresses in concrete. Use f'_{ci} = 28 MPa, f'_c = 35 MPa, Maximum jacking force = 1700 kN, Force at service load = 1300 kN. Diameter of hole = 120 mm. **(17)**

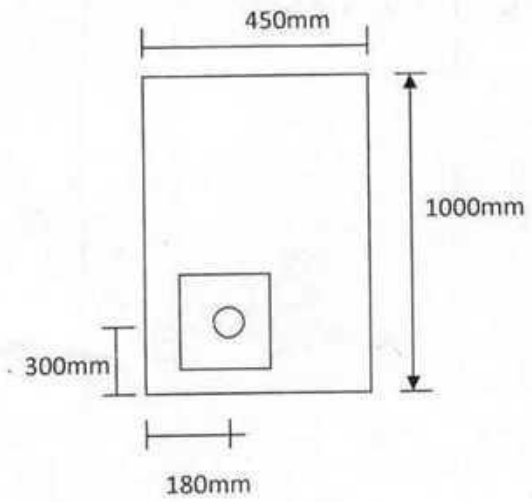


Figure 4

(b) Determine k_b and k_t of the following section (Figure 5) **(8)**

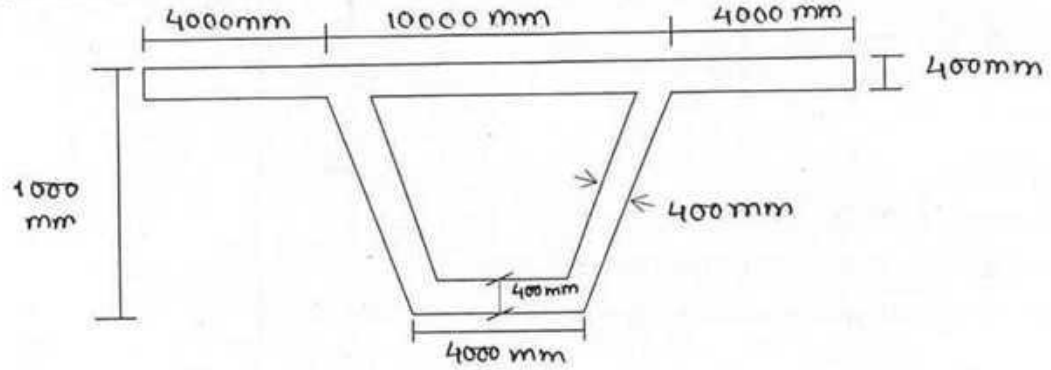


Figure 5

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc Engineering (Civil)

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

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

1. Write the equation for the stress-strain behaviour in tension of the 18x1 inch plate with the residual stress shown in Fig. 1 at an imposed tensile strain of 0.0013 in./in. What is the tangent modulus at this strain? Given: F_y=36 ksi; E=30000 ksi. 8 ⅓

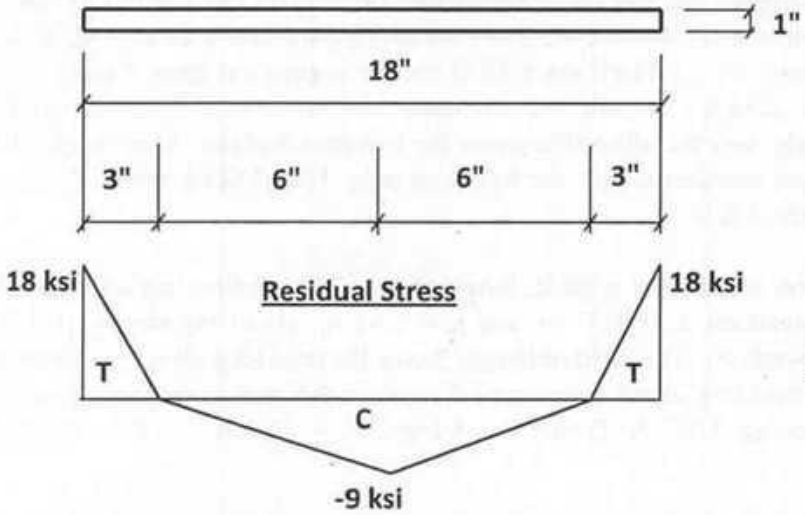


Fig. 1

2. Determine the effective length coefficients for the columns of the frame shown in Fig. 2. The moments of inertia in inch^4 for the columns and beams are shown in the figure. Annexure-1 provides necessary nomographs. 8 ⅓

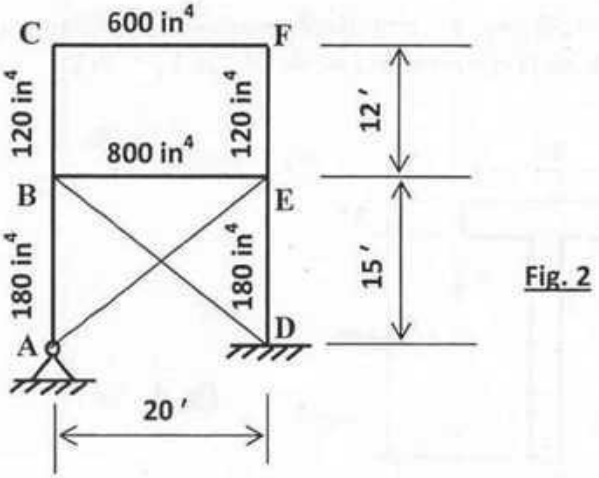
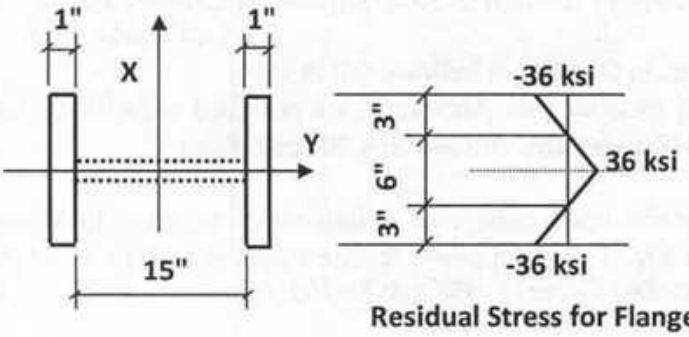


Fig. 2

3. The residual stress distribution in flanges of a webless H section for a column is shown in Fig. 3. Determine the values of $I_{x,eff}$ and $I_{y,eff}$ (effective moments of inertia about x and y axes) and critical slenderness ratio, L/r_x and L/r_y for strong and weak axis buckling, if the column with the given section buckles at an imposed uniform compressive strain of –0.0016 in./in. Given: $F_y = 60$ ksi and $E = 30000$ ksi. 8 ⅓



Residual Stress for Flanges

Fig. 3

4. Assuming that compact-section requirement satisfies, select the lightest W section for a beam to carry a uniformly distributed live load of 2 kips/ft and a dead load, including the weight of the beam, of 1.1 kip/ft on a 36-ft simply supported span. Check the selected section for full compact section requirements and determine the spacing of lateral bracings to comply with the allowable stress for compact section. Also check whether the deflection criterion satisfies or not for live load only. Use ASD method. Given: $F_y = 36$ ksi. See Annexures-2 & 3. 8 ⅓

5. A W18x76 section is used for a 20 ft. long column. The section has an area of 22.3 in^2 and a radius of gyration, $r_x = 7.73$ in. and $r_y = 2.61$ in. about the strong axis X and the weak axis Y respectively. If effective length factor for buckling about major axis X is $K_x = 1$ and that for buckling about minor axis Y is $K_y = 0.5$, calculate the allowable load P for the column using AISC/ASD method. Given: $F_y = 42$ ksi and $E = 29000$ ksi. See Annexure-4. 8 ⅓

6. Using LRFD method, calculate the design strength of a W24x76 section for a 20 ft. long column. The section has an area of 22.4 in^2 and radius of gyration, $r_x = 9.69$ in. and $r_y = 1.92$ in. about the strong axis X and the weak axis Y respectively. Given: Effective length factor for buckling about major axis X is $K_x = 2$ and that for buckling about minor axis Y is $K_y = 0.7$; $F_y = 42$ ksi and $E = 29000$ ksi. See Annexure-5. 8 ⅓

7. Compute the yield moment and plastic moment capacities and shape factor for major axis bending of the section shown in Fig. 4. Given: $F_y = 36$ ksi. 8 ⅓

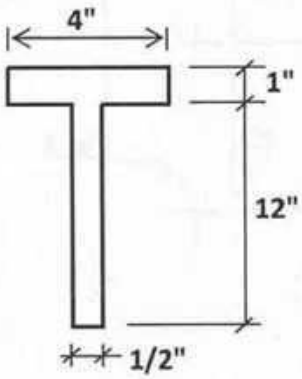


Fig. 4

8. Using AISC/ASD method, determine the block shear allowable load for the joint shown in Fig. 5. Fasteners are 3/4-in A-325 bolts in standard holes. All plates are A36 steel. Allowable stress in shear on net shear area = $0.3F_u$ & allowable stress in tension on net tension area = $0.5F_u$. 8 ⅓

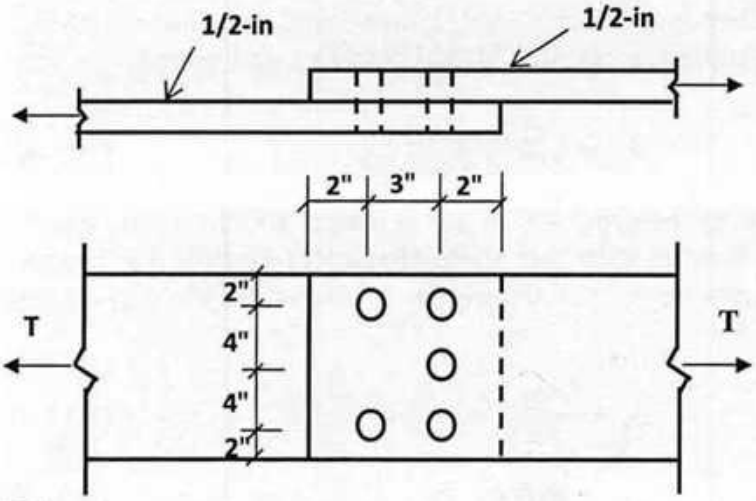
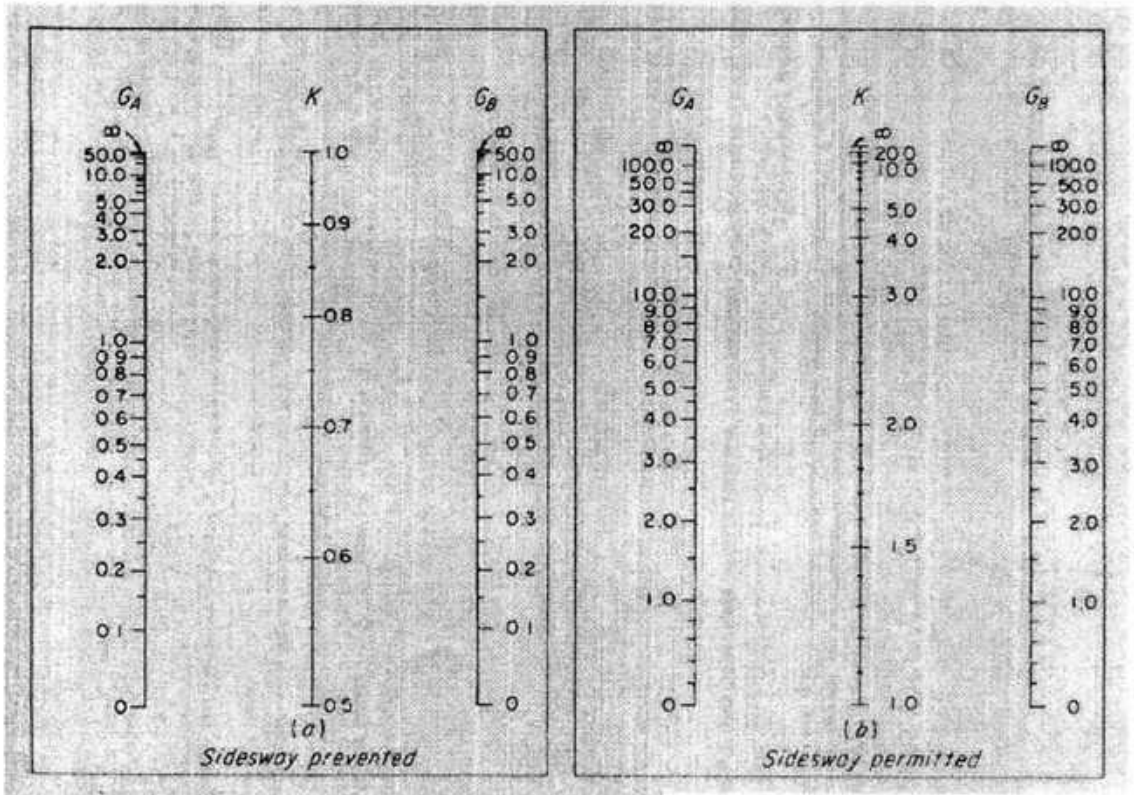


Fig. 5

ANNEXURE-1



Nomograph for effective length of columns.

ANNEXURE-2

Specification Formulas

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

Compact section: $$F_b = 0.66F_y \tag{5-16a}$$

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:

$$L_c = \frac{76b_f}{\sqrt{F_y}} \tag{5-17a}$$

$$L_c = \frac{20{,}000}{F_y d/A_f} \tag{5-17b}$$

DEFLECTION CRITERIA FOR LIVE LOAD STRESS F_b:

$$\frac{L}{d} \leq \frac{480}{F_b}$$

ANNEXURE-2 (Contd.)

TABLE 5-3
Limiting values of beam flange and web slenderness

		AISC/ASD		AISC/LRFD			
Type of element	**Ratio**	**Compact**	**Noncompact**	**Compact**	**Noncompact**	**AREA**	**AASHTO**
Flange of rolled I or channel	$\frac{b}{t}$	$\frac{65^a}{\sqrt{F_y}}$	$\frac{95^a}{\sqrt{F_y}}$	$\frac{65^a}{\sqrt{F_y}}$	$\frac{141^{a,b}}{\sqrt{F_{yw}-10}}$	$\frac{2300^c}{\sqrt{F_y}, \text{psi}}$	$\frac{3250^{d,e}}{\sqrt{f}, \text{psi}}$
Flange of welded I	$\frac{b}{t}$	$\frac{65^a}{\sqrt{F_y}}$	$\frac{95^a}{\sqrt{F_y/k_c}}$	$\frac{65^a}{\sqrt{F_{yf}}}$	$\frac{106^a}{\sqrt{F_{yw}-16.5}}$	$\frac{2300^c}{\sqrt{F_y}, \text{psi}}$	$\frac{3250^{d,e}}{\sqrt{f}, \text{psi}}$
Flange of box	$\frac{b}{t}$	$\frac{190}{\sqrt{F_y}}$	$\frac{238}{\sqrt{F_y}}$	$\frac{190}{\sqrt{F_y}}$	$\frac{238}{\sqrt{F_y - F_r}}$	$\frac{7500}{\sqrt{F_y}, \text{psi}}$	$\frac{5000^e}{\sqrt{f}, \text{psi}}$
Web[f] of I	$\frac{d^g}{t}$	$\frac{640}{\sqrt{F_b}}$					
Web[f] of I	$\frac{h^{h,i}}{t}$	...	$\frac{760}{\sqrt{F_b}}$	$\frac{640}{\sqrt{F_y}}$	$\frac{970}{\sqrt{F_y}}$		

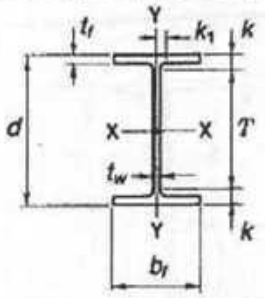
F_y in ksi except where noted.
F_{yf} = yield stress of flange.
F_{yw} = yield stress of web.
F_b = allowable bending stress for beams with no axial force.
F_r = residual stress = 10 ksi for rolled shapes, 16.5 ksi for welded shapes.
$k_c = 4.05/(h/t)^{0.46}$ if $h/t > 70$; otherwise $k_c = 1$. See Art. 5-8.
[a] b = half width of flange.
[b] $106/\sqrt{F_{yw}-16.5}$ for welded shapes.
[c] b = distance from free edge of flange to fillet.
[d] b = width of flange.
[e] f = service-load stress.
[f] Webs in flexure. See Art. 5-15 for flexure and axial compression.
[g] d = depth of beam.
[h] h = clear distance between flanges of rolled, built-up, or formed sections (AISC/ASD).
[i] h = twice the distance from the neutral axis to the nearest line of fasteners at the compression flange or to the inside face of the

ANNEXURE-3

ALLOWABLE STRESS DESIGN SELECTION TABLE
S_x For shapes used as beams

F_y = 50 ksi			S_x	Shape	Depth d	F_y'	F_y = 36 ksi		
L_c	L_u	M_R					L_c	L_u	M_R
Ft	Ft	Kip-ft	In.^{3}		In.	Ksi	Ft	Ft	Kip-ft
10.3	11.1	1230	448	W 33×141	33¼	—	12.2	15.4	887
8.8	11.0	1210	439	W 36×135	35½	—	12.3	13.0	869
9.4	19.4	1200	436	W 30×148	30⅝	—	11.1	18.7	863
10.3	35.5	1150	419	W 18×211	20⅝	—	12.2	49.3	830
11.2	27.1	1150	417	W 21×182	22¾	—	13.2	37.6	826
11.6	21.1	1140	414	W 24×162	25	—	13.7	29.3	820
12.5	16.6	1130	411	W 27×146	27⅜	—	14.7	23.0	814
9.9	10.8	1120	406	W 33×130	33⅛	—	12.1	13.8	804
9.4	11.6	1050	380	W 30×132	30¼	—	11.1	16.1	752
11.1	25.1	1060	380	W 21×166	22½	—	13.1	34.8	752
10.3	32.7	1060	380	W 18×192	20⅝	—	12.1	45.4	752
11.6	18.9	1020	371	W 24×146	24¾	—	13.6	26.3	735
8.6	10.7	987	359	W 33×118	32⅞	—	12.0	12.6	711
9.4	10.8	976	355	W 30×124	30⅛	—	11.1	15.0	703
9.0	13.3	949	345	W 27×129	27⅝	—	10.6	18.4	683
10.2	30.0	946	344	W 18×175	20	—	12.0	41.7	681
9.4	9.9	905	329	W 30×116	30	—	11.1	13.8	651
11.5	15.8	905	329	W 24×131	24½	—	13.6	23.4	651
11.2	21.8	905	329	W 21×147	22	—	13.2	30.3	651
10.1	27.5	853	310	W 18×158	19¾	—	11.9	38.3	614
8.9	9.8	822	299	W 30×108	29⅞	—	11.1	12.3	592
9.0	11.5	822	299	W 27×114	27¼	—	10.6	15.9	592
11.1	19.6	811	295	W 21×132	21⅞	—	13.1	27.2	584
11.5	14.9	800	291	W 24×117	24¼	—	13.5	20.8	576
10.0	25.3	776	282	W 18×143	19½	—	11.8	35.1	558
11.1	18.3	751	273	W 21×122	21⅛	—	13.1	25.4	541
7.9	9.7	740	269	W 30× 99	29⅛	—	10.9	11.4	533
9.0	10.2	734	267	W 27×102	27⅛	—	10.6	14.2	529
11.4	13.2	710	258	W 24×104	24	58.5	13.5	18.4	511
10.0	23.1	704	256	W 18×130	19¼	—	11.8	32.2	507
11.1	16.8	685	249	W 21×111	21½	—	13.0	23.3	493
7.2	9.6	674	245	W 30× 90	29½	58.1	10.0	11.4	485
8.1	12.0	674	245	W 24×103	24½	—	9.5	16.7	485
8.9	9.5	668	243	W 27× 94	26⅞	—	10.5	12.8	481
10.1	21.0	635	231	W 18×119	19	—	11.9	29.1	457
11.0	15.4	624	227	W 21×101	21⅜	—	13.0	21.3	449
8.1	10.9	611	222	W 24× 94	24¼	—	9.6	15.1	440
8.0	9.4	586	213	W 27× 84	26¾	—	10.5	11.0	422
10.0	18.7	561	204	W 18×106	18¾	—	11.8	26.0	404
8.1	9.6	539	196	W 24× 84	24⅛	—	9.5	13.3	388
7.5	12.1	528	192	W 21× 93	21⅝	—	8.9	16.8	380
13.1	31.7	523	190	W 14×120	14½	—	15.5	44.1	376
10.0	17.4	517	188	W 18× 97	18⅝	—	11.8	24.1	372

ANNEXURE-3 (Contd.)



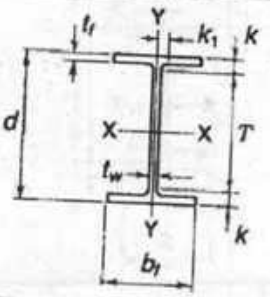
W SHAPES
Dimensions

Desig-nation	Area A	Depth d		Web			Flange				Distance		
				Thickness t_w		$\frac{t_w}{2}$	Width b_f		Thickness t_f		T	k	k_1
	In.^{2}	In.		In.		In.	In.		In.		In.	In.	In.
W 30×148[b]	43.5	30.67	30⅝	0.650	⅝	5/16	10.480	10½	1.180	1³/16	26¾	2	1
×132	38.9	30.31	30¼	0.615	⅝	5/16	10.545	10½	1.000	1	26¾	1¾	1 1/16
×124	36.5	30.17	30⅛	0.585	9/16	5/16	10.515	10½	0.930	15/16	26¾	1 11/16	1
×116	34.2	30.01	30	0.565	9/16	5/16	10.495	10½	0.850	⅞	26¾	1⅝	1
×108	31.7	29.83	29⅞	0.545	9/16	5/16	10.475	10½	0.760	¾	26¾	1 9/16	1
× 99	29.1	29.65	29⅝	0.520	½	¼	10.450	10½	0.670	11/16	26¾	1 7/16	1
× 90	26.4	29.53	29½	0.470	½	¼	10.400	10⅜	0.610	9/16	26¾	1 5/16	1
W 27×539[c]	158.0	32.52	32½	1.970	2	1	15.255	15¼	3.540	3 9/16	24	4½	1⅞
×494[c]	145.0	31.97	32	1.810	1 13/16	15/16	15.095	15⅛	3.270	3⅜	24	4	1 13/16
×448[a]	131.0	31.42	31⅜	1.650	1⅝	13/16	14.940	15	2.990	3	24	3 11/16	1½
×407[a]	119.0	30.87	30⅞	1.520	1½	¾	14.800	14¾	2.720	2¾	24	3 7/16	1 7/16
×368[a]	108.0	30.39	30⅜	1.380	1⅜	11/16	14.665	14⅝	2.480	2½	24	3 3/16	1 5/16
×336[a]	98.7	30.00	30	1.260	1¼	⅝	14.545	14½	2.280	2¼	24	3	1 3/16
×307[a]	90.2	29.61	29⅝	1.160	1 3/16	⅝	14.445	14½	2.090	2 1/16	24	2 13/16	1¼
×281[a]	82.6	29.29	29¼	1.060	1 1/16	9/16	14.350	14⅜	1.930	1 15/16	24	2⅝	1 3/16
×258	75.7	28.98	29	0.980	1	½	14.270	14¼	1.770	1¾	24	2½	1⅛
×235	69.1	28.66	28⅝	0.910	15/16	½	14.190	14¼	1.610	1⅝	24	2 5/16	1⅛
×217	63.8	28.43	28⅜	0.830	13/16	7/16	14.115	14⅛	1.500	1½	24	2 3/16	1 1/16
×194	57.0	28.11	28⅛	0.750	¾	⅜	14.035	14	1.340	1 5/16	24	2 1/16	1
×178	52.3	27.81	27¾	0.725	¾	⅜	14.085	14⅛	1.190	1³/16	24	1⅞	1 1/16
×161	47.4	27.59	27⅝	0.660	11/16	⅜	14.020	14	1.080	1 1/16	24	1 13/16	1
×146	42.9	27.38	27⅜	0.605	⅝	5/16	13.965	14	0.975	1	24	1 11/16	1
W 27×129[b]	37.8	27.63	27⅝	0.610	⅝	5/16	10.010	10	1.100	1⅛	24	1 13/16	15/16
×114	33.5	27.29	27¼	0.570	9/16	5/16	10.070	10⅛	0.930	15/16	24	1⅞	15/16
×102	30.0	27.09	27⅛	0.515	½	¼	10.015	10	0.830	13/16	24	1 9/16	15/16
× 94	27.7	26.92	26⅞	0.490	½	¼	9.990	10	0.745	¾	24	1 7/16	15/16
× 84	24.8	26.71	26¾	0.460	7/16	¼	9.960	10	0.640	⅝	24	1⅜	15/16

[a]For application refer to Notes in Table 2.
[b]Heavier shapes in this series are available from some producers.
Shapes in shaded rows are not available from domestic producers.

ANNEXURE-3 (Contd.)

W SHAPES
Properties



Designation	Nominal Wt. per Ft	Compact Section Criteria $\frac{b_f}{2t_f}$	Compact Section Criteria F_y'	Compact Section Criteria $\frac{d}{t_w}$	Compact Section Criteria F_y''	r_T	$\frac{d}{A_f}$	Elastic Properties Axis X-X I	Axis X-X S	Axis X-X r	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Plastic Modulus Z_x	Plastic Modulus Z_y
	Lb.		Ksi		Ksi	In.		In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.	In.^{3}	In.^{3}
W 30×148[b]	148	4.4	—	47.2	29.7	2.70	2.48	6680	436	12.4	227	43.3	2.28	500	68.0
×132	132	5.3	—	49.3	27.2	2.68	2.87	5770	380	12.2	196	37.2	2.25	437	58.4
×124	124	5.7	—	51.6	24.8	2.66	3.09	5360	355	12.1	181	34.4	2.23	408	54.0
×116	116	6.2	—	53.1	23.4	2.64	3.36	4930	329	12.0	164	31.3	2.19	378	49.2
×108	108	6.9	—	54.7	22.0	2.61	3.75	4470	299	11.9	146	27.9	2.15	346	43.9
× 99	99	7.8	—	57.0	20.3	2.57	4.23	3990	269	11.7	128	24.5	2.10	312	38.6
× 90	90	8.5	58.1	62.8	16.7	2.56	4.65	3620	245	11.7	115	22.1	2.09	283	34.7
W 27×539[a]	539	2.2	—	16.5	—	4.10	0.60	25500	1570	12.7	2110	277	3.86	1880	437
×494[a]	494	2.3	—	17.7	—	4.05	0.65	22900	1440	12.6	1890	250	3.81	1710	394
×448[a]	448	2.5	—	19.0	—	4.01	0.70	20400	1300	12.5	1670	224	3.57	1530	351
×407[a]	407	2.7	—	20.3	—	3.96	0.77	18100	1170	12.3	1480	200	3.52	1380	313
×368[a]	368	3.0	—	22.0	—	3.93	0.84	16100	1060	12.2	1310	179	3.48	1240	279
×336[a]	336	3.2	—	23.8	—	3.89	0.90	14500	970	12.1	1170	161	3.45	1130	252
×307[a]	307	3.5	—	25.5	—	3.86	0.98	13100	884	12.0	1050	146	3.42	1020	227
×281[a]	281	3.7	—	27.6	—	3.84	1.06	11900	811	12.0	953	133	3.40	933	206
×258	258	4.0	—	29.6	—	3.81	1.15	10800	742	11.9	859	120	3.37	850	187
×235	235	4.4	—	31.5	—	3.78	1.25	9660	674	11.8	768	108	3.33	769	168
×217	217	4.7	—	34.3	56.3	3.76	1.34	8870	624	11.8	704	99.8	3.32	708	154
×194	194	5.2	—	37.5	47.0	3.74	1.49	7820	556	11.7	618	88.1	3.29	628	136
×178	178	5.9	—	38.4	44.9	3.72	1.66	6990	502	11.6	555	78.8	3.26	567	122
×161	161	6.5	—	41.8	37.8	3.70	1.82	6280	455	11.5	497	70.9	3.24	512	109
×146	146	7.2	—	45.3	32.2	3.68	2.01	5630	411	11.4	443	63.5	3.21	461	97.5
W 27×129[b]	129	4.5	—	45.3	32.2	2.59	2.51	4760	345	11.2	184	36.8	2.21	395	57.6
×114	114	5.4	—	47.9	28.8	2.58	2.91	4090	299	11.0	159	31.5	2.18	343	49.3
×102	102	6.0	—	52.6	23.9	2.56	3.26	3620	267	11.0	139	27.8	2.15	305	43.4
× 94	94	6.7	—	54.9	21.9	2.53	3.62	3270	243	10.9	124	24.8	2.12	278	38.8
× 84	84	7.8	—	58.1	19.6	2.49	4.19	2850	213	10.7	106	21.2	2.07	244	33.2

[a]For appli
[b]Heavier s
Shapes in

ANNEXURE-4

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-5

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

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

in which

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

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering IX (Earthquake Resistant Design and Retrofitting) — Course Code: CE 423

Time: 2 Hour — Full Marks: 50

*There are 7 **(Seven)** questions. Answer any **5 (Five)**.*

N.B. Students are allowed to bring Chapter 21 of ACI code. Handwritten documents/handwriting on the code are not permitted.

1. a) State d'Alembert's Principle. **(3)**
   b) Explain Dynamic Equilibrium. **(3)**
   c) Write short notes on: **(4)**
      (i) TMD
      (ii) TLD

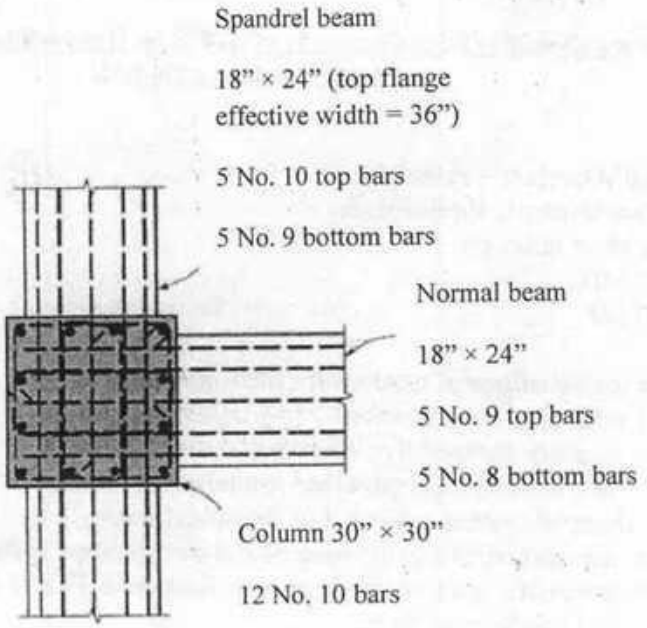
2. a) Write the equations of motions for the following cases: **(4)**
      (i) Undamped free vibration
      (ii) Viscously damped free vibration
      (iii) Undamped system subjected to sinusoidal force
      (iv) Damped system subjected to sinusoidal force
   b) Define undamped, critically damped and overdamped systems. **(3)**
   c) Draw schematic plot of Deformation Response Factor (R_d) vs Frequancy Ratio (β) and briefly explain it. **(3)**

3. A one storey building is idealized as a rigid girder supported by weightless columns. In order to evaluate the dynamic properties of this structure, a free vibration test is made, in which the roof system (rigid girder) is displaced laterally by a hydraulic jack and then suddenly released. During the jacking operation, it is observed that a force of 16.4 kips is required to displace the girder 2 in. At the end of four complete cycles, the time is 2.0 sec and the amplitude is 1 in. From these data compute the following: **(10)**
      (i) Damping ratio
      (ii) Natural period of undamped vibration
      (iii)Stiffness
      (iv)Weight
      (v) Damping coefficient

4. An 18 in. wide by 24 in. deep (including 6 in slab) reinforced concrete beam spans between two interior columns in a building frame designed for a region of high seismic risk. The clear span is 24 ft and the c/c spacing of the beams is 20 ft. The reinforcement at the face of the support consists of four No. 9 top bars and four No. 8 bottom bars in one layer. Design the shear reinforcement for the regions adjacent to the column faces for DL = 1.0 kip and LL = 1.2 kip. Also **(10)**

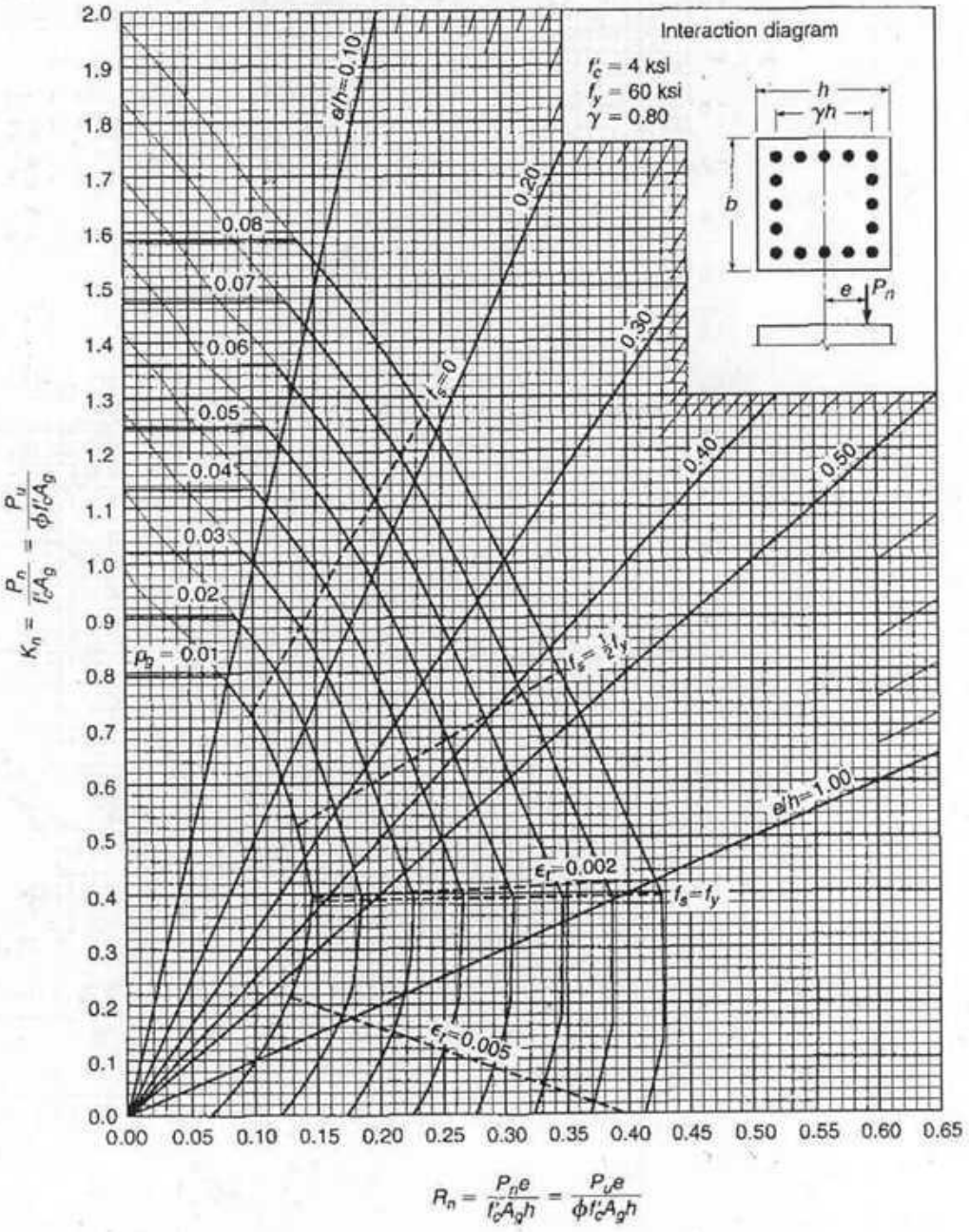
draw a cross-section of the beam. Given: $f_c^{'}$ = 4000 psi and f_y = 60,000 psi.

5. The exterior joint shown in the Figure below is part of a reinforced concrete frame designed to resist earthquake loads. A 6 in. slab, not shown, is reinforced with No. 4 bars spaced 6 in. center to center at the same level as the flexural steel in the beams. The member section dimensions and reinforcement are as shown. The frame story height is 10 ft. Material strengths are $f_c^{'}$ = 4000 psi and f_y = 60,000 psi. The maximum factored axial load on the upper column framing into the joint is 1800 kips, and the maximum factored axial load on the tower column is 2000 kips. Check if the joint satisfy weak beam-strong column design (ACI 21.6.2.2). **(10)**

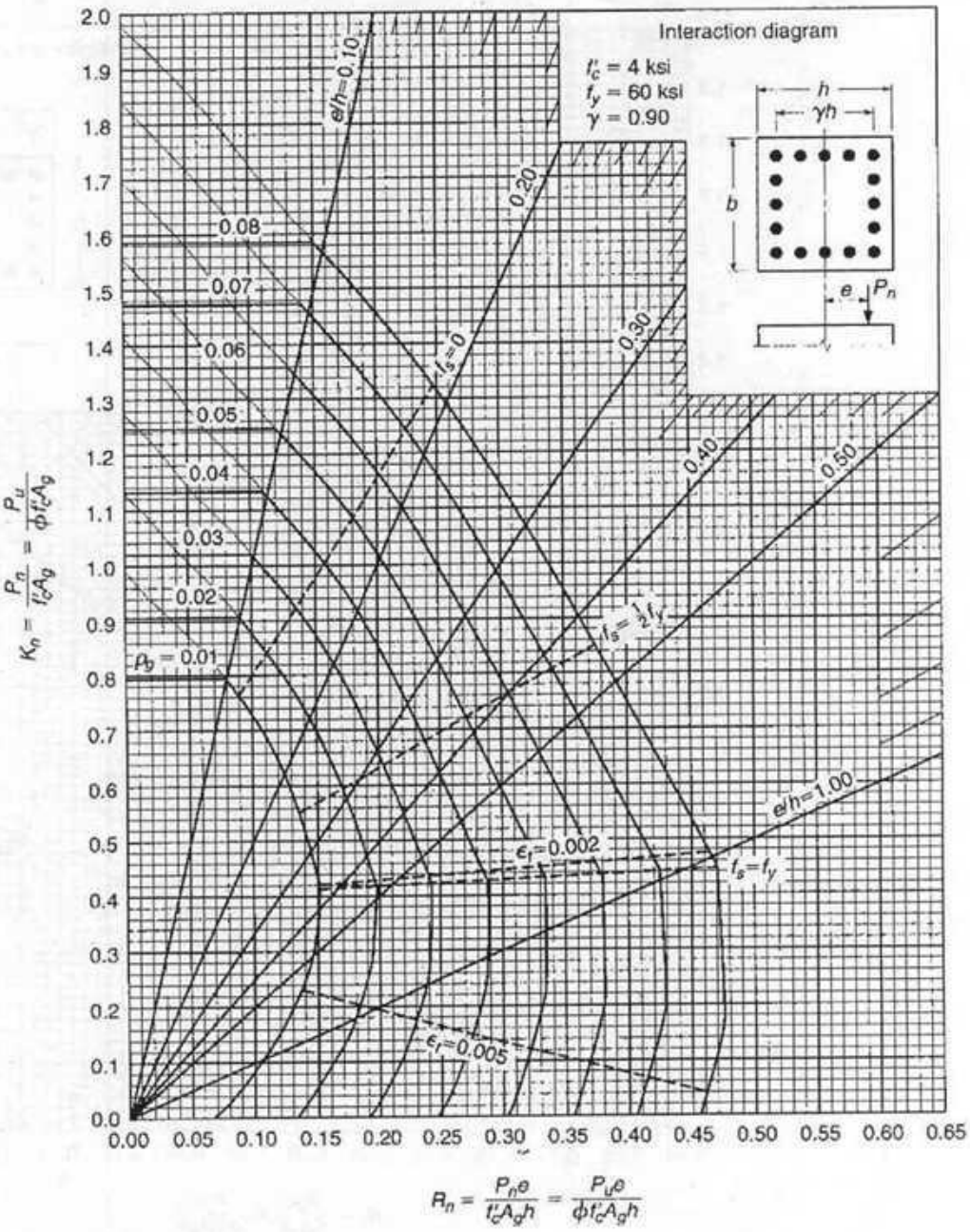


6. For the same column in **Question 5**, determine the minimum transverse reinforcement required over the length l_0 . **(10)**

7. Briefly describe different methods for seismic retrofitting of existing RC structures. **(10)**



GRAPH A.7
Column strength interaction diagram for rectangular section with bars on four faces and $\gamma = 0.80$.



GRAPH A.8
Column strength interaction diagram for rectangular section with bars on four faces and $\gamma = 0.90$.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering III | Course Code: CE 431
Time- 2 hour | Full marks: 100 (=25×4)

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

1. (a) Discuss the general considerations for selecting a suitable collection vehicle. (5)

   (b) Discuss the different stages of landfill gas generation. (5)

   (c) Describe the leachate management system. (5)

   (d) Explain the mechanisms of anaerobic digestion process. (10)

2. (a) To estimate future waste quantities, what factors need to be considered? (5)

   (b) Categorize collection method based on the mode of operation. (5)

   (c) In a hauled-container system, solid waste from a new industrial park is to be collected in large containers, some of which will be used in conjunction with stationary compactors. Based on traffic studies at similar parks, it is estimated that the average time to drive from the garage to the first container and from the last container to the garage each day will be 35 and 45 minutes, respectively. The average time required to drive between containers is 8 minutes and the one-way distance to the disposal site is 35 km (speed limit: 56 km/h). The off-route factor is 14%. Determine the number of containers that can be emptied per day, based on 9 hour working day. Also determine the actual length of the working day. (10)

   (d) Describe briefly the risks associated with poor management of solid waste. (5)

3. (a) Discuss the potential environmental impact of landfill gases. (5)

   (b) Categorize and discuss the activities involved in materials recycling processes. (5)

   (c) Suppose the annualized cost of purchasing, fueling, and maintaining a compactor truck is given by the following expression: (10)
   Annualized cost ($/yr) = 25000 + 4000V; where V is the truck volume in cubic meter. These trucks require three person crew with labor charged at $20 per hour each (including benefits). Do an economic analysis of the collection system where an 11 m^3 truck collects refuse from 355 households each day. The generation of waste is 65 lb per week. The truck and crew work for 5 days a week, and curb side pick-up is provided twice a week for each house. What is the cost per ton of waste collected and what is the cost per household annually.

(d) Compare between pyrolysis and thermal gasification. (5)

4. (a) Write down explanatory notes on any three of the following: (3×3)
i) Underground injection, ii) Hazardous waste management, iii) Land farming and iv) Incineration.

(b) What do you understand by biogas technology? Discuss the environmental aspects of biogas technology. (3+3)

(c) 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 formula of the typical waste are as follows: (10)

Without water: $C_{65.0}H_{96.3}O_{41.8}N$

Given that the total weight of the organic material in 110 lb of solid waste is equal to 90 lb including moisture. Assume 5% of the decomposable material will remain as an ash. Also given that the specific weight of methane and carbon dioxide are 0.0448 and 0.1235 lb/ft^3 respectively.

5. (a) Given that 3000 kg/h of municipal solid waste with 800 kg/h glass is applied to a rotary screen for the removal of glass prior to shredding. Weight of underflow is 600 kg/h and weight of glass in screen underflow is 250 kg/h, determine the recovery efficiency and effectiveness of the screen. (10)

(b) Compare between Material Recovery Facility and Full Stream Processing Facility. (5)

(c) Define composting. What are the main objectives of composting? (2+3)

(d) Do you suggest ocean can be a place for dumping hazardous waste? Justify your answer. (5)

Formulae:

1. $C_aH_bO_cN_d + (\frac{4a-b-2c+3d}{4})\, H_2O \longrightarrow (\frac{4a+b-2c-3d}{8})\, CH_4 + (\frac{4a-b+2c+3d}{8})\, CO_2 + dNH_3$

2. Percentage Recovery $= \frac{W_1 f_1 (100)}{W_2 f_2}$

3. Effectiveness $= \frac{W_1 f_1}{W_2 f_2}\{1-\frac{W_1(1-f_1)}{W_2(1-f_2)}\}$

4. CRF $= \frac{i(1+i)^n}{(1+i)^n-1}$

5. $T_{hcs} = PT_{hcs} + q + m + nx$

6. $PT_{hcs} = pc + uc + dbc$

7. $M_{dc} = \{(1- W) * L - (t_1 + t_2)\} / T_{hcs}$

Table 4.1: Typical values for haul constant coefficients m and n

Type of haul	Speed limit km/h	m h/trip	n h/km
Communal	88	0.016	0.011
Block	72	0.022	0.014
Kerbside	56	0.034	0.018
Door-to-door	40	0.050	0.025

Adapted from: Peavy et al., 1985

Table 4.2: Typical data for computing equipment and labour requirements for hauled- and stationary-container collection

Collection					
Vehicle	Loading method	Compaction ratio, z	Pick up loaded container and deposit empty container, h/trip	Empty contents of loaded container, h/container	At-site time t_s, h/trip
Hauled container (Tilt-frame)	Mechanical	2.0–4.0	0.50		0.129
Stationary container (Compactor)	Mechanical	2.0–4.0		0.050	0.15

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering IV | Course Code: CE 433
Time:2 hrs. | Full Marks: 100

(Answer any four from the five questions listed below.)
Assume any reasonable value for missing data, if any.

Q.1(a) Describe the concept of natural succession in lakes. Briefly describe classifications of lake according to the degree of enrichment with nutrients and organic matter. (10)

Q.1(b) In a typical lake section, show different layers during summer stratification along with the temperature and DO profile. (5)

Q.1(c) Explain the simple phosphorous model for lakes. A lake (surface area = 200x106 m^2) is fed by a stream with an average flow of $30m^3/s$ and having an average phosphorous concentration of 0.005 mg/L. A wastewater treatment plant adds 10mg/L of phosphorous with a flow of 0.4 m^3/sec. The settling rate of phosphorous is estimated to be 10m/year. (i) Estimate average phosphorous concentration in lake, (ii) Estimate phosphorous removal rate at treatment plant to keep phosphorous concentration below 0.01 mg/L. (5+5)

Q.2(a) List important sources and sinks of DO in rivers and stream. What are the key model assumptions used in derivation of the classic Streeter-Phelps oxygen sag equation? List limitations of oxygen sag curve equation. (4+3+3)

Q.2(b) Derive expressions for rate of de-oxygenation and rate of re-aeration in the classic Streeter-Phelps oxygen sag equation for a river receiving organic waste. (5+5)

Q.2(c) Explain the effect of temperature and NBOD on the shape of the DO sag curve. (5)

Q.3(a) List the categories of water pollutants. Discuss the sources and effects of: (i) thermal pollution, and (ii) Heavy metal pollution. (4+2+2)

Q.3(b) Define BOD. What is the difference between CBOD and NBOD? Describe a typical problem in determining BOD_5 of wastewater samples in laboratory. What is usually done to overcome this problem? (2+2+2+2)

Q.3(c) For a BOD test (at 25°C) initial DO= 7.5 mg/L. After 5 days, DO=2.3 mg/L. Given, dilution factor = 45, BOD rate constant, k = 0.20 /day at 20°C, and θ = 1.047. (4.5+4.5)

(i) Calculate BOD5 at 20°C.
(ii) Calculate BOD remaining after 5 days at 20°C.

Q.4(a) A BOD test is run using 100ml of treated wastewater mixed with 200ml of pure water. The initial DO of the mix is 9.0 mg/L. After 5 days, the DO is 4.0 mg/L. After a long period of time, the DO is 2.0 mg/L and it no longer drops. Ignoring nitrification, what would be the remaining BOD after seven days have elapsed? (13)

Q.4(b) What do you mean by waste assimilation capacity of streams? Mention the factors controlling waste assimilation of a stream for the following types of pollutants: (i) Oxygen demanding wastes, (ii) Pathogens, (iii) Persistent pollutants. (3+3+3+3)

Q. 5 A public community discharges 2.8 m^3/sec of untreated domestic wastewater, through a storm-water outfall into a river. The untreated wastewater has an ultimate BOD of 220mg/L with no dissolved oxygen in it. Upstream of the storm-water outfall, the river has a flow rate of 12 m^3/sec, a velocity of 0.35 m/sec, ultimate BOD of 5.0 mg/L, and a DO content of 7.8 mg/L. The saturation value of DO (at river temperature) is 9.0 mg/L. The de-oxygenation co-efficient (k_d) is 0.52 day^{-1}, and the re-aeration co-efficient (k_r) is 0.71 day^{-1}. Assume complete mixing immediately downstream of the outfall and that the river has same cross section and flow rate both upstream and downstream of the outfall. Further assume the wastewater and the river has the same temperature. (Use normal graph paper for solving this problem)

(i) What are the initial oxygen deficit (D_o) and the ultimate BOD just downstream of the outfall (before any reaction takes place)? (5)

(ii) Calculate DO at distances, in kilometers: 5, 10, 15, 20, 25, 75, 100, 130, 160, and 210 downstream the outfall. Draw the DO profile using a plain graph paper. (5)

(iii) From the DO profile, estimate the distance downstream of the outfall when the river becomes completely devoid of oxygen (i.e. DO = 0). (5)

(iv) Estimate the length of the river stretch, in kilometers, that remains under septic condition (i.e., DO = 0). (5)

(v) Estimate the distance downstream of the outfall where the river can restore back to DO level of 5.0 mg/L when different fish species and other aquatic life forms could survive. (5)

$$D_t = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t} - e^{-k_r t}\right) + D_a . e^{-k_r t}$$

$$t_c = \frac{1}{k_r - k_d} \ln\left\{\frac{k_d}{k_d}\left(1 - \frac{D_a(k_r - k_d)}{k_d L_0}\right)\right\}$$

$$D_c = \frac{k_d}{k_r} L_o . e^{-k_d t_c}$$

---------- X ----------

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering IV | Course Code: CE 433
Time:2 hrs. | Full Marks: 100

(Answer any four from the five questions listed below.)
Assume any reasonable value for missing data, if any.

Q.1(a) Describe the concept of natural succession in lakes. Briefly describe classifications of lake according to the degree of enrichment with nutrients and organic matter. (10)

Q.1(b) In a typical lake section, show different layers during summer stratification along with the temperature and DO profile. (5)

Q.1(c) Explain the simple phosphorous model for lakes. A lake (surface area = 200x106 m^2) is fed by a stream with an average flow of $30m^3/s$ and having an average phosphorous concentration of 0.005 mg/L. A wastewater treatment plant adds 10mg/L of phosphorous with a flow of 0.4 m^3/sec. The settling rate of phosphorous is estimated to be 10m/year. (i) Estimate average phosphorous concentration in lake, (ii) Estimate phosphorous removal rate at treatment plant to keep phosphorous concentration below 0.01 mg/L. (5+5)

Q.2(a) List important sources and sinks of DO in rivers and stream. What are the key model assumptions used in derivation of the classic Streeter-Phelps oxygen sag equation? List limitations of oxygen sag curve equation. (4+3+3)

Q.2(b) Derive expressions for rate of de-oxygenation and rate of re-aeration in the classic Streeter-Phelps oxygen sag equation for a river receiving organic waste. (5+5)

Q.2(c) Explain the effect of temperature and NBOD on the shape of the DO sag curve. (5)

Q.3(a) List the categories of water pollutants. Discuss the sources and effects of: (i) thermal pollution, and (ii) Heavy metal pollution. (4+2+2)

Q.3(b) Define BOD. What is the difference between CBOD and NBOD? Describe a typical problem in determining BOD_5 of wastewater samples in laboratory. What is usually done to overcome this problem? (2+2+2+2)

Q.3(c) For a BOD test (at 25°C) initial DO= 7.5 mg/L. After 5 days, DO=2.3 mg/L. Given, dilution factor = 45, BOD rate constant, k = 0.20 /day at 20°C, and θ = 1.047. (4.5+4.5)

(i) Calculate BOD5 at 20°C.
(ii) Calculate BOD remaining after 5 days at 20°C.

Q.4(a) A BOD test is run using 100ml of treated wastewater mixed with 200ml of pure water. The initial DO of the mix is 9.0 mg/L. After 5 days, the DO is 4.0 mg/L. After a long period of time, the DO is 2.0 mg/L and it no longer drops. Ignoring nitrification, what would be the remaining BOD after seven days have elapsed? (13)

Q.4(b) What do you mean by waste assimilation capacity of streams? Mention the factors controlling waste assimilation of a stream for the following types of pollutants: (i) Oxygen demanding wastes, (ii) Pathogens, (iii) Persistent pollutants. (3+3+3+3)

Q. 5 A public community discharges 2.8 m^3/sec of untreated domestic wastewater, through a storm-water outfall into a river. The untreated wastewater has an ultimate BOD of 220mg/L with no dissolved oxygen in it. Upstream of the storm-water outfall, the river has a flow rate of 12 m^3/sec, a velocity of 0.35 m/sec, ultimate BOD of 5.0 mg/L, and a DO content of 7.8 mg/L. The saturation value of DO (at river temperature) is 9.0 mg/L. The de-oxygenation co-efficient (k_d) is 0.52 day^{-1}, and the re-aeration co-efficient (k_r) is 0.71 day^{-1}. Assume complete mixing immediately downstream of the outfall and that the river has same cross section and flow rate both upstream and downstream of the outfall. Further assume the wastewater and the river has the same temperature. (Use normal graph paper for solving this problem)

(i) What are the initial oxygen deficit (D_o) and the ultimate BOD just downstream of the outfall (before any reaction takes place)? (5)

(ii) Calculate DO at distances, in kilometers: 5, 10, 15, 20, 25, 75, 100, 130, 160, and 210 downstream the outfall. Draw the DO profile using a plain graph paper. (5)

(iii) From the DO profile, estimate the distance downstream of the outfall when the river becomes completely devoid of oxygen (i.e. DO = 0). (5)

(iv) Estimate the length of the river stretch, in kilometers, that remains under septic condition (i.e., DO = 0). (5)

(v) Estimate the distance downstream of the outfall where the river can restore back to DO level of 5.0 mg/L when different fish species and other aquatic life forms could survive. (5)

$$D_t = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t} - e^{-k_r t}\right) + D_o . e^{-k_r t}$$

$$t_c = \frac{1}{k_r - k_d} \ln\left\{\frac{k_d}{k_d}\left(1 - \frac{D_o(k_r - k_d)}{k_d L_0}\right)\right\}$$

$$D_c = \frac{k_d}{k_r} L_o . e^{-k_d t_c}$$

---------- X ----------

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering VII — Course Code: CE439
Time: 2 hours — Full marks: 100

Question No. 5 is compulsory. Answer THREE from the rest.
(Note: Assume any missing data)

1. (a) Explain Environmental Management Plan (EMP) in EIA and writedown the purpose of implementing EMP in EIA. (8)

   (b) Why public involvement is most significant part in EIA? What are the participation methods has been practiced in Bangladesh ? (10)

   (c) Prepare an environmental Monitoring plan with the examples of air quality and flora & fauna at construction stage of a project. (7)

2. (a) Draw and discuss the flow chart of EIA process. (15)

   (b) Why Environmental legislation has been implemented poorly in developing countries and how this situation can be improved ? (5)

   (c) Write down the obstacles in EIA implementation. (5)

3. (a) Briefly discuss the environmental clearance procedures for Green, Orange-A, Orange-B and Red Categories project in Bangladesh. (11)

   (b) Discuss the importance of baseline surveys in EIA. (4)

   (c) Categories the following project into green, orange-A, orange-B and red category projects according to the Environment Conservation Rules, 1997. (10)

   I. Photography (movie and x-ray excluded).
   II. Sports goods (excluding plastic made items).
   III. Medical and surgical instrument (excluding production).
   IV. Dairy Farm, 10 (ten) cattle heads or below in urban areas and 25 cattle heads or below in rural areas.
   V. Restaurant.
   VI. Production of gold ornaments.Hazardous waste storage, treatment and disposal site including hazardous waste
   VII. Hotel, multi-storied commercial & apartment building.
   VIII. Animal feed.

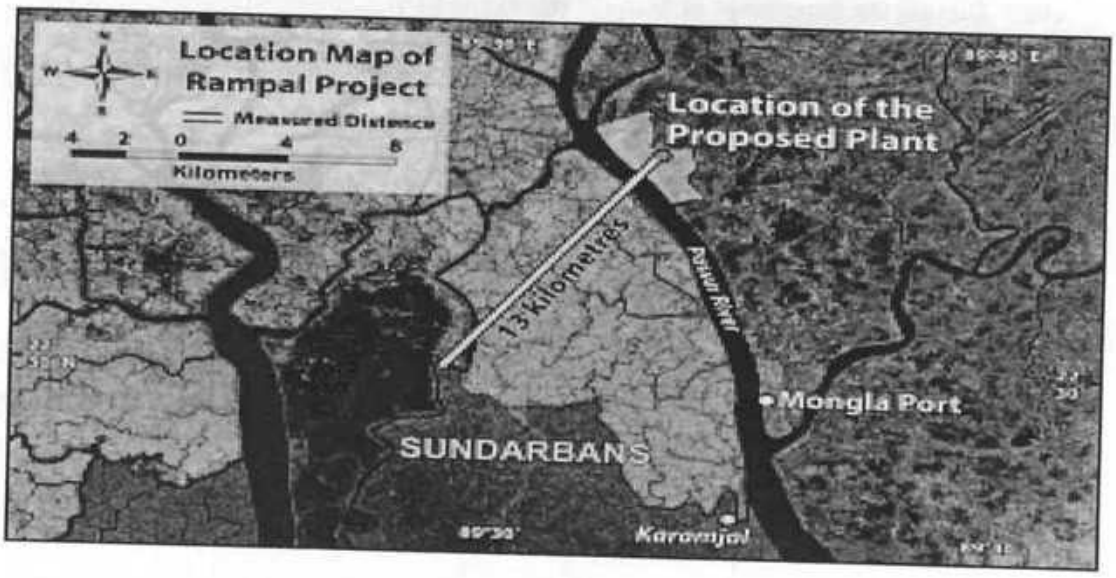
IX. Power plant.
X. Explosives.

4. (a) Define "ecologically critical areas". What are the "ecologically critical areas" in Bangladesh has already been declared by the Ministry of Environment and Forest (MOEF) ? (7)

(b) Prepare a template for impact identification for three stages of construction. The affected environmental component due to implementation of a road in a district will be occurred as following: (18)
Air, land, noise, vibration, flora, fauna andworkers health and safety.

5. (a) Read the following description of Rampal Power Plant carefully and enlighten all the adverse impacts of the plant & also specify the types of impact beside all adverse impacts. (25)

Bangladesh Power Development Board (BPDB) and National Thermal Power Corporation (NTPC) of India signed a Contract to build the 1320 MW Rampal Coal Fired Power Plant at Bagerhat under joint venture. Rampal power plant is considered as Bangladesh-India Friendship Power project and it promises to be the largest power plant in Bangladesh built on 1,834 acres of land, located 14-km north of the Sundarbans, the world's largest mangrove forest. EIA report by Bangladesh DoE states that a radius of 10 kilometres from the Sunderbans is considered the Environmentally Critical Area (ECA) and the proposed spot for the plant is 14 kilometres away from the forest, making the plant not risky as it is 4 kilometres away from the Sunderbans' ECA. But the findings through Geographical Information System (GIS) software exhibit that this distance is between 9 and 13 kilometres.



[Fig: Location map of Rampal Coal Based Thermal Electricity Plant showing distance from Sundarbans]

The 1,834 acres of aquired land significantly consist of farming lands, fisheries and habitations of the population of dependent on the mentioned. Over 95 % of the allocated land is capable of being harvested thrice a year that every year produced 1,285 tons of rice and 561.41 metric tons of fish. Over 8,000 families are permanent residents of the allocated land and among them 7,500 families live on the mentioned farming and fisheries. Therefore these families will lose their homes and incomes.

The EIA report by the Bangladesh DoE lists a number of damages to be caused at the development stage of the power plant infrastructure. They are- increased maritime transports, undue chemical discharges from the naval vehicles, sound and light pollution etc., which will potentially disturb the natural habitats of the local rivers and canals. It will hamper the ecosystem which comprises of Royal Bengal Tigers, deer, dolphins and the forestry. Again, deforestation and dredging that would be done to facilitate the increased transportation will also harm the local environment.

According to the EIA report, 4.72 million tons of coal will be burnt to produce the estimated 1,320 megawatt of electricity at the proposed Rampal power plant which will produced 7.9 million tons of carbon dioxide. In addition to carbon dioxide, the plant will release 142 tons of sulphur dioxide and 85 tons of nitrogen dioxide every day, amounting at 51,830 tons and 31,025 tons respectively in a year. As a result, the natural density of sulphur dioxide and nitrogen dioxide in the Sunderbans will rise at many folds, which will trigger the eventual destruction of the forest.

As result of burning 4.72 million tons of coal per year, 750,000 tons of fly ash and 200,000 tons of bottom ash will be produced. These wastes, comprising of fly ash, bottom ash and liquid ash, are extremely hazardous. They contain hazardous and radioactive metals like arsenic, lead, mercury, nickel, vanadium, beryllium, barium, cadmium, chromium, selenium and radium. There may be a great risk if some of fly ash will be released in and around the Sunderbans by the Rampal plant, which would not only fatally affect the forest, but also cause a range of lung diseases including pneumonia to the people living nearby.

Again, the EIA states that the plant, for rotation of turbines and to use as a coolant, would require extracting 9,150 cubic metre of water per hour from the Passur River adjacent to the Sunderbans and would release back 5,150 cubic metre of water, implying that the ultimate extraction of water from the river would be 4,000 cubic metre per hour. This loss of water would impact the salinity, flow, tidal patterns, habitats and ecosystem of the river.

Another factor is that temperature of the plant's gaseous discharge, released in the atmosphere from a 275-metre high chimney, will be 125 degree Celsius which would indeed raise the surrounding atmospheric temperature of the area.

It is not disagreed that the demand of energy is spiraling in proportion to the paces of industrialization and population growth. At the circumstance, it is imperative that before going for environmentally risky projects we must consider the alternative sources.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013, Set B
Program: B. Sc. Engineering (Civil)

Course Title: Geotechnical Engineering II | Course Code: CE 441
Time: 3 hours | Full Marks: 120 (20 X 6 = 120)

Answer any 6 (six) of the following 8 (eight) questions

1. (a) Write down any three general guidelines used for (i) selection of spacing/numbers of boreholes (ii) selection of depth of boreholes for different civil engineering projects. 6

   (b) Write down the names of any four boring/drilling techniques generally used for sub-surface exploration. Write a very short note on the one frequently used in Bangladesh. 6

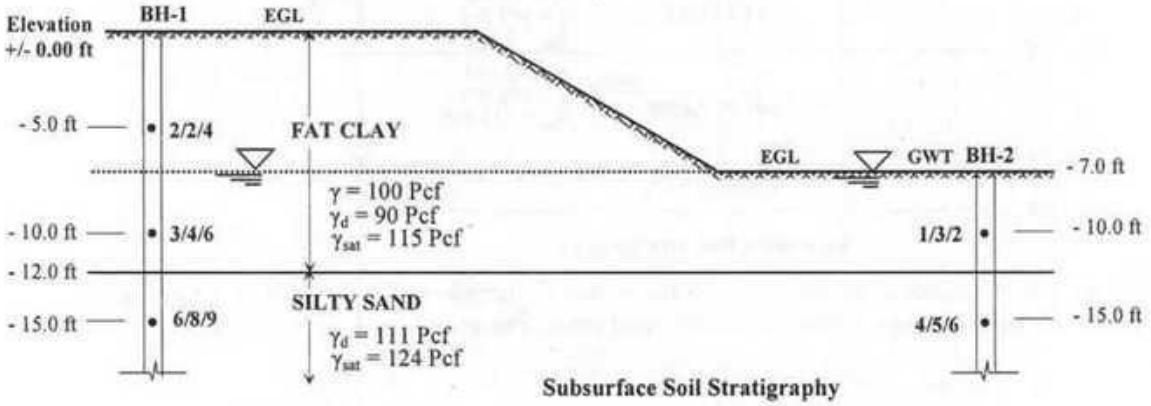
   (c) Write short notes on (any two): 4 x 2=8

   (i) Pressuremeter Test (ii) Cone Penetrometer Test (iii) Vane Shear Test

2. (a) The outside and inside diameters of a split-spoon sampler are 2 inches and 1.4 inches, respectively and those of a Shelby tube sampler are 3 inches and 2.85 inches, 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. 4

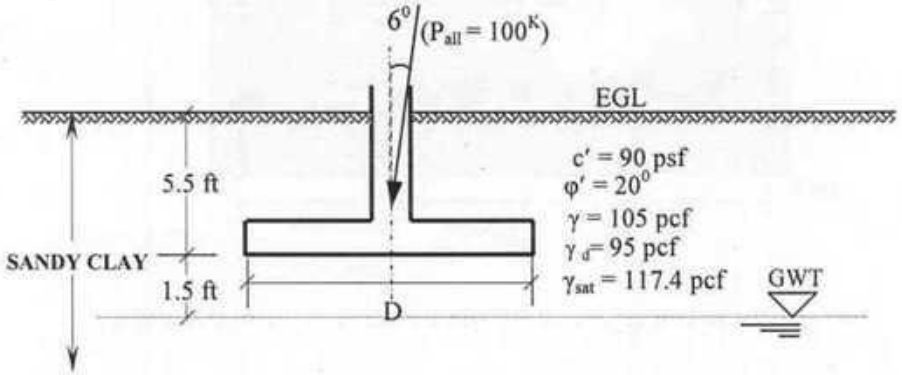
   (b) Discuss, in brief, disturbed and undisturbed sampling. 6

   (c) Subsurface stratigraphy as obtained at a site for **BH-1** and **BH-2** are summarized in the figure below. Determine the field SPT values and estimate the corrected SPT values as required for both boreholes. Also determine undrained cohesion and angle of internal friction for clay and sand. 10

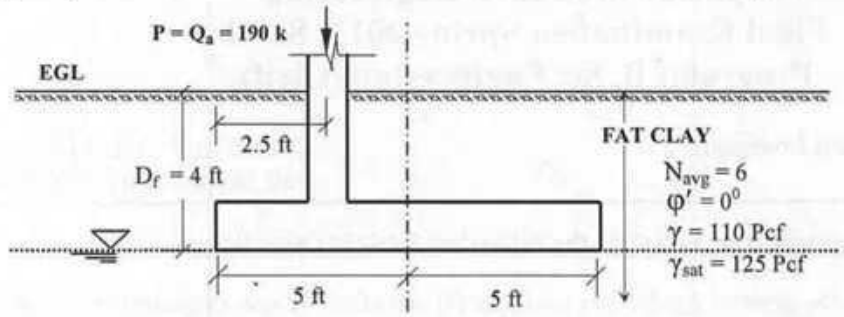


Subsurface Soil Stratigraphy

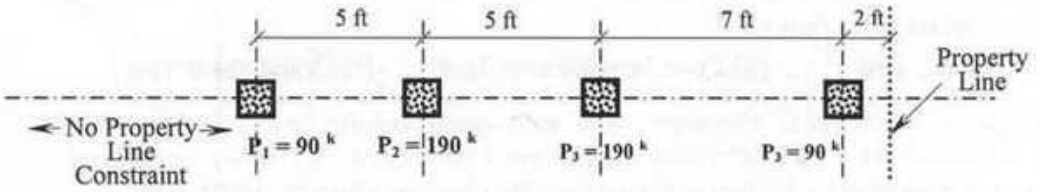
3. (a) A shallow circular foundation is to be constructed in sandy clay soil as shown in the following figure. Design the size of the circular footing (use GBCE) for the allowable column load (D ranges between 3 and 6 feet). Use a factor of safety of 2.5 and assume Df/B < 1). 10



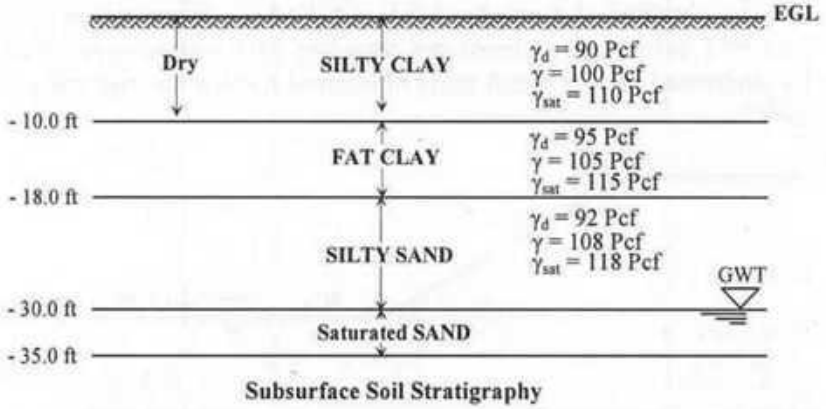
(b) Allowable load (FS=2.5) of an eccentrically loaded rectangular footing (Breadth as shown below) using Meyerhof's effective area method is 190 k. Determine the length of the footing. 10



4. (a) Design the size of a rectangular combined footing for the conditions shown below (q_a = 2.0 tsf). 3

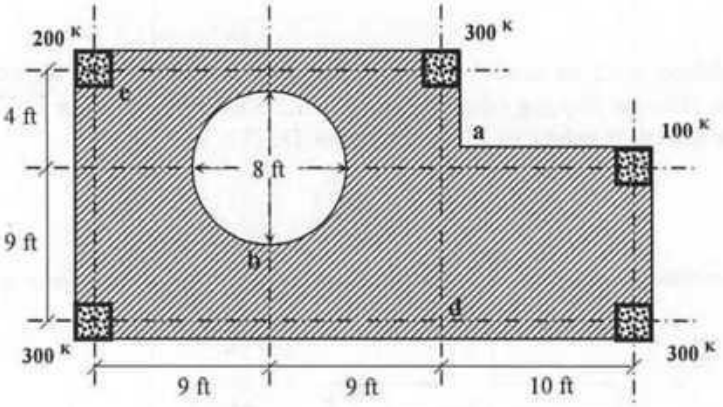


(b) For fully compensated condition, if the depth of a mat foundation is 25 ft below EGL, determine the number of stories that could be built considering uniform per floor load as 200 psf. 3



Subsurface Soil Stratigraphy

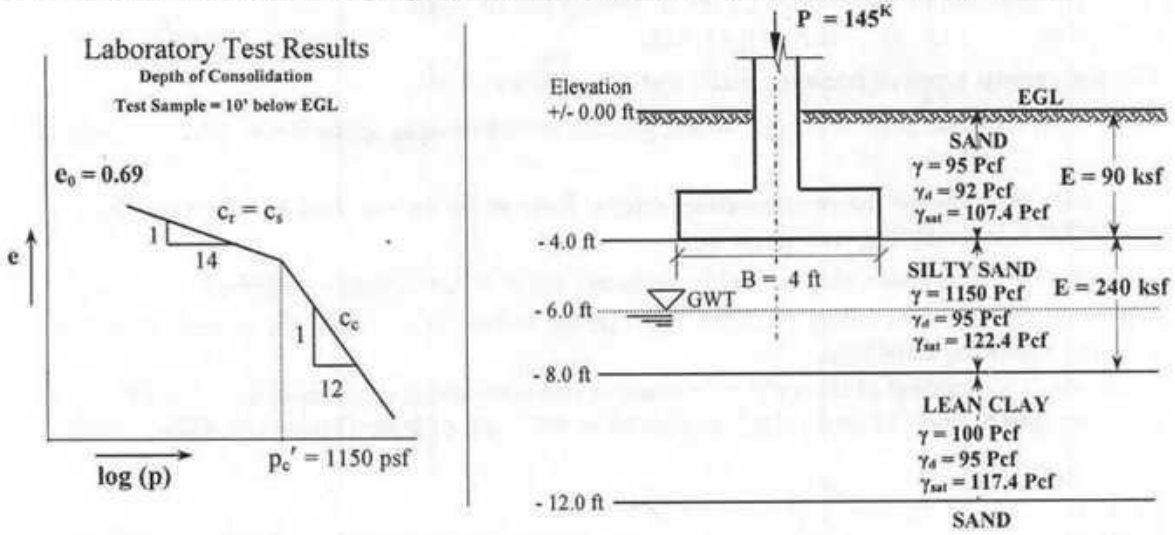
(c) The plan of a mat foundation with column loads and dimensions (24 in x 24 in each for all columns) is shown in the figure below. Calculate soil pressures at points a, b, c, d and geometric centroid. 14



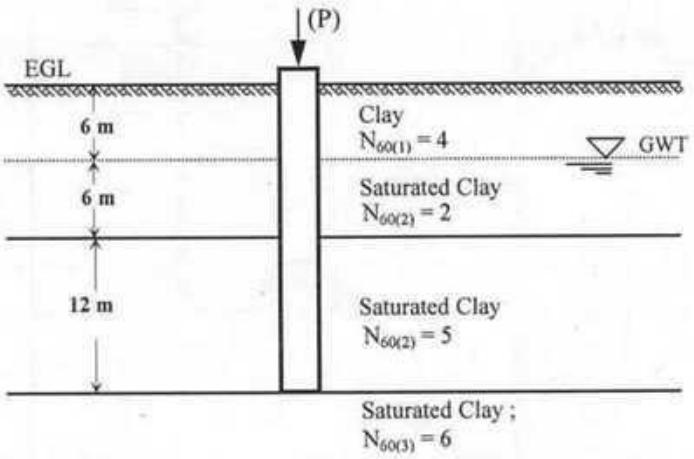
5. (a) Classify (mention names only) foundation systems generally used to support superstructures. 4

(b) What do you understand by shallow and deep foundations? 2

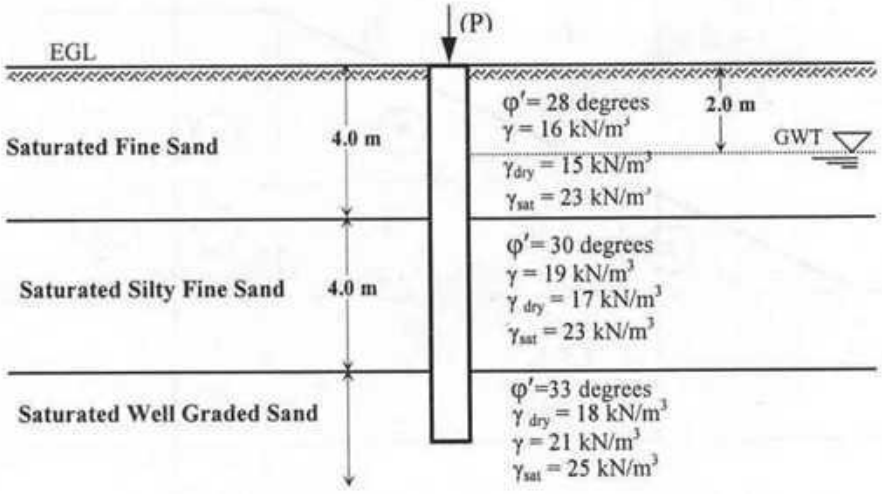
(c) A rectangular footing (4 ft x 6 ft) designed as per allowable bearing capacity based on shearing failure is shown in the following figure. Estimate settlements for both sand and clay layers. 14



6. (a) For the soil stratigraphy as shown below, a pre-cast concrete driven pile (0.5 by 0.5 meter) was installed. Calculate the capacity of the individual pile. 8



(b) A 10-meter long single bored pile (circular: Dia = 0.8 m) installed in different sand deposits are shown below. Estimate the allowable capacity of the single pile. (Nq* = 25 for φ'= 28 degrees; Nq* = 32 for φ'= 30 degrees; Nq* = 52 for φ'= 33 degrees) 12



7. (a) Classify (mention names only) pile foundations according to their materials (composition), method of installation and displacement criteria. 4

(b) Draw arrangement of group piles for the following sets of piles. 4
(i) 7 piles (ii) Double row for a wall

(c) Discuss various types of retaining walls that are generally used. 8

(d) Show with sketches general proportioning geometries for designing cantilever retaining walls. 4

8. (a) Show with sketches the major alternatives (steps) that can be investigated to obtain the desired factor of safeties in designing retaining walls. 5

(b) Name few features where slope stability problems are to be addressed/considered. 3

(c) Determine the factor of safety (stability) against the failure arc through the natural (original) slope for the following condition: 12
As an aftermath of removal of the surface vegetation and consequent occurrence of torrential rain, the shear strength of layer I (sandy clay) is reduced by 65% and of layer II (clay) by 80%.

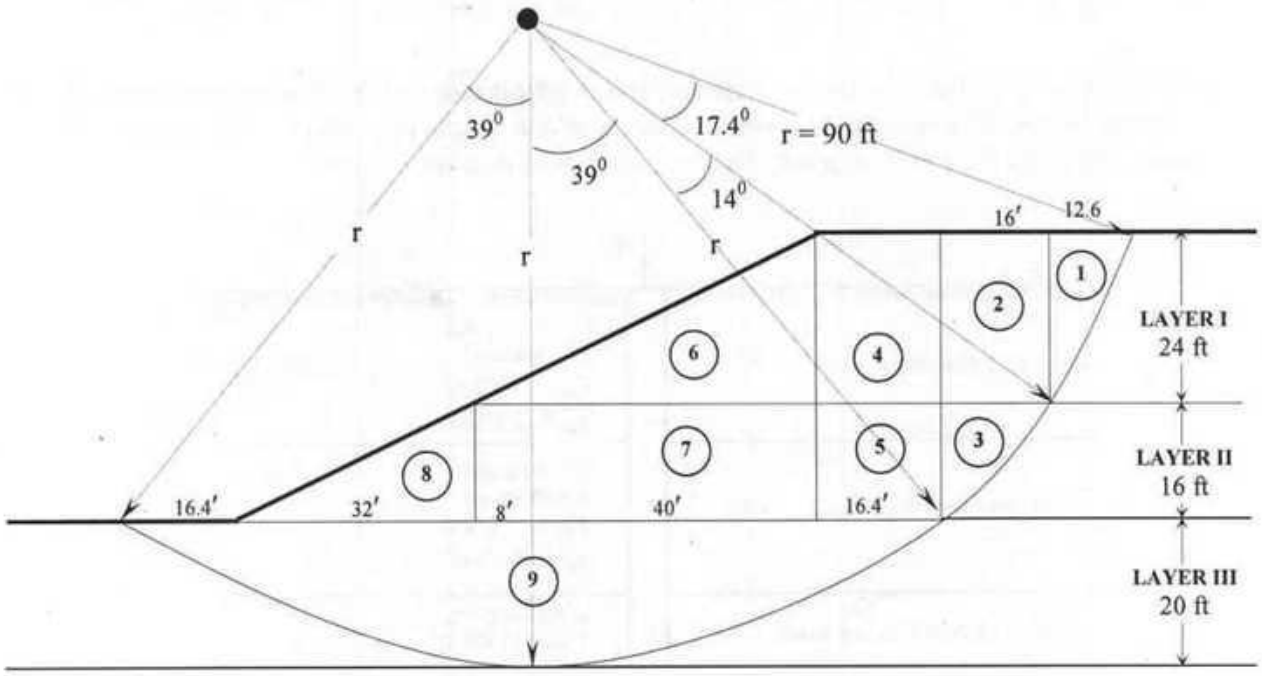
LAYER I:
Sandy Clay
Average SPT Blow Count, N = 4
Unit Weight = 110 pcf

LAYER II:
Clay
Average SPT Blow Count, N = 5
Unit Weight = 115 pcf

LAYER III:
Clay
Average SPT Blow Count, N = 8
Unit Weight = 120 pcf

Segment No.	Area (ft^2)	Arm (ft)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---
6	---	---
7	---	---
8	---	---
9	---	0

--- to be calculated



05.09.13

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
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 (8) questions. Answer any SIX (6)

1. (a) Write the categories of the common gauges with their usual dimension. Why is it desirable to use uniform gauges in a country? (4 +10)
   (b) What are the functions of rail? (6)
   (c) What is coning of wheel? If a rail section is used of 52 kg/m, what will be the maximum axle load? (3+2)

2. (a) What are the requirements of ideal sleeper? (10)
   (b) Define turn out and tongue rail. What does it mean by calling-on signal and repeater signal? (4+5)
   (c) What are the functions of ballast? (6)

3. (a) Briefly differentiate between cant deficiency and cant excess. (5)
   (b) What should be the equilibrium cant on a M.G. curve of 4^0 for an average speed of 60 kmph? What will be the maximum permissible speed after allowing the maximum cant deficiency? (9)
   (c) Define interlocking. Name the functional classification of station. Write short note on Marshalling Yard. (2+3+6)

4. (a) Define pavement. Sketch different layers of the Rigid and Flexible pavement. (2+3)
   (b) What is ESAL? Briefly describe the factors which are considered in pavement design. Write down the difference between tar and asphalt. (2+6+3)
   (c) Name the laboratory test for determining consistency of the bituminous material. From a California Bearing Ratio (CBR) test the load against the penetration of 0.1 in. and 0.2 in. was found to be 200 lb and 250 lb respectively. If the diameter of the penetrating piston is 1.95 in. then calculate the CBR value for the sub-grade soil sample. (3+6)

5. (a) Why low cost road is important? Which materials are required for bituminous soil stabilized road and cement stabilized road? (10)
   (b) Establish a relationship between degree of curvature and versine of a curve. (7)
   (c) What is crossing? Define Reliability in AASHTO method. What are the design criteria in PCA method? (2+3+3)

6. (a) Draw the qualitative curves found from the Marshall method of design. (9)
   (b) If the percentage by weight for both coarse aggregate and fine aggregate is 48 and bulk specific gravity is 2.7 and 2.6 respectively, what is the bulk specific gravity of the aggregate? If the maximum specific gravity of the paving mix is 2.5 and specific gravity of Asphalt cement is 1.03, Calculate the effective specific gravity of aggregate. (6)

(c) What are the considerations for erosion analysis? What are stress ratio factor, ADT and ADTT? If the ADT and ADTT is 10000 and 20% respectively, find out the total number of the trucks for a 4 lane rural interstate highway with projection factor of 1.6 for 20 years. Assume value if required. (3+3+4)

7. (a) During the first year of service, a pavement on a Rural Interstate highway is expected to accommodate the following numbers of vehicles in the design lane. (20)

No. of Vehicles	Truck Factor
24000	0.21
10000	0.60
7500	1.10
30000	1.20

Design a minimum thickness of flexible pavement (i.e. thickness of different layers) for this traffic condition.
Given:
Sub grade soil CBR value is 1
Design life is 20 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 ($a_2 = 0.14$, $m_2 = 0.4$ and $E_2 = 30$ ksi)
- Crushed stone sub base ($a_3 = 0.11$, $m_3 = 0.9$ and $E_3 = 14.5$ ksi)

Note: Use attached figure.

(b) What is pavement serviceability concept? (5)

8. (a) Determine the minimum thickness of a lane of cement concrete rigid pavement in a rural interstate highway which can be used to carry the following expected loading of heavy vehicle over the design period of 20 years. Combined k of the subgrade and 4 in untreated subbase was taken to be 130 lb/in^3. The modulus of rupture of the concrete is 650 lb/in^2. Assume doweled joints and no concrete shoulder. Consider reasonable values for the missing data if any. (LSF =1.2, consider fatigue analysis only) (18)
Note: Use attached figure and table.

Axle load, kips		Expected repetitions
Single axles	30	8,000
	28	10,000
	26	30,000
	24	55,000
	22	75,000
Tandem axles	52	20,000
	48	40,000
	44	60,000

(b) Describe the factors for concrete pavement design by the PCA method (7)

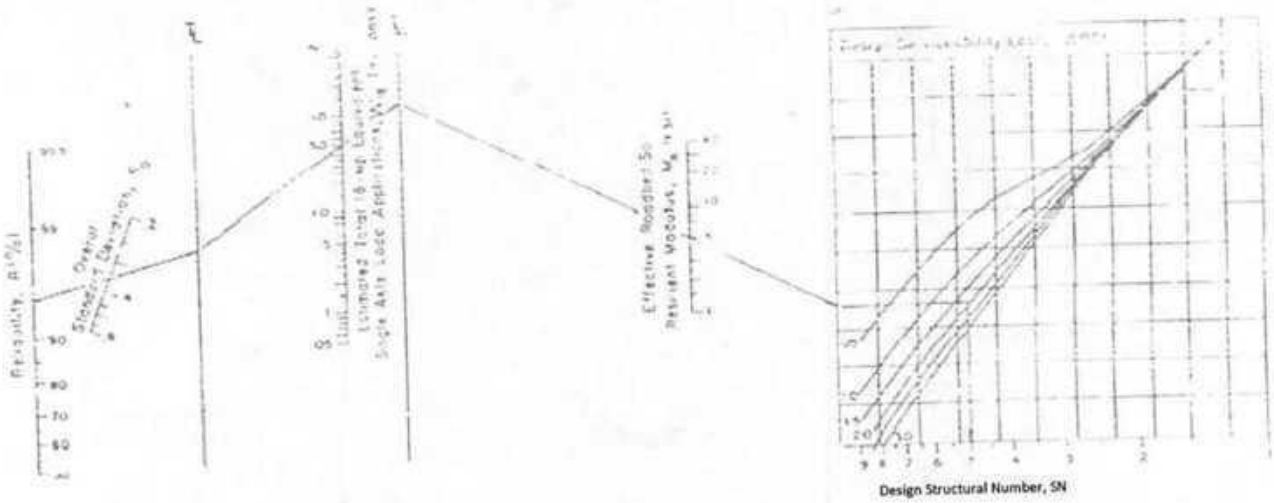
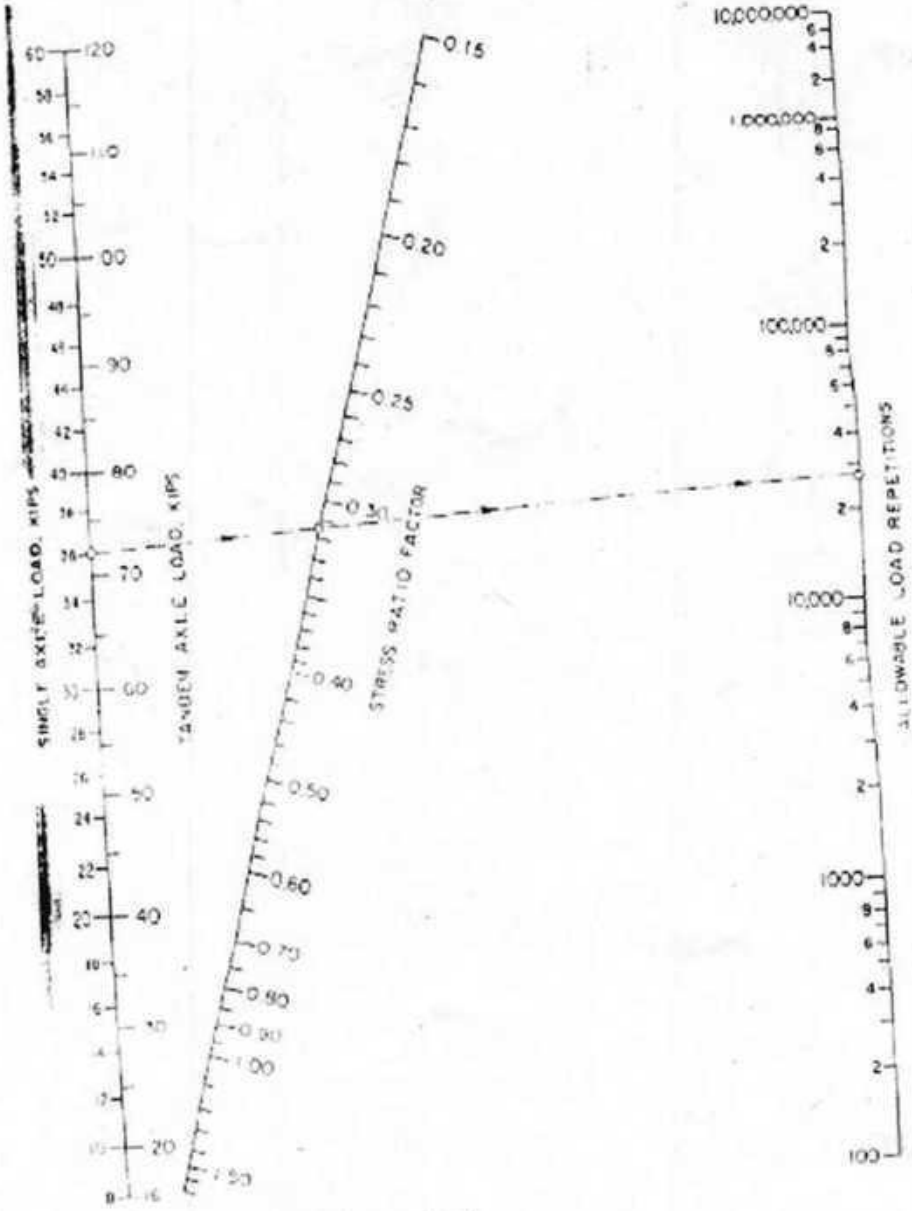


Figure: AASHTO design chart for flexible pavements

Table 6a. Equivalent Stress — Nb 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	698/586	616/500	571/460	540/435	498/406	448/376	417/361
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	469/416	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	210/168
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



Fatigue analysis

University of Asia Pacific
Department of Civil Engineering
Final Examination (Sec A) Spring – 2013
Program: B. Sc. Engineering (Civil)

Course Title: Transportation Engineering II | Course Code: CE 451
Time: 3 hours | Full Marks: 120

Section I

Answer any 3 (three) from the following 4 (four) questions.

Assume any reasonable value, if at all required.

1. a) Write down the principal differences between a Flexible and a Rigid Pavement. Which Pavement is more suitable in the climatic condition of Bangladesh and why? (7)

   b) Define resistance to wear of materials. Describe commonly accepted investigations for the hardness of aggregates. (5)

   c) The dry mass of a sample of aggregate is 1206.0 gm. The mass in a saturated surface dry condition is 1226.8 gm. The volume of the aggregates, excluding the volume of absorbed water, is 440.6 cm^3. Find the apparent specific gravity, the bulk specific gravity and the percentage of absorption. (8)

2. a) Briefly discuss CBR and Resilient Modulus. (6)

   b) What do you understand by Pavement Serviceability Concept and its use in Road Maintenance? (6)

   c) Calculate Equivalent 18000-lb Standard Axle Load Applications during the first year of service of a pavement, the pavement is expected to accommodate the following number of vehicles in the classes shown below: (8)

Vehicle Type	Number of Vehicles	Truck Factor
Two-axle, four-tire	87,600	0.02
Two-axle, six-tire	23,600	0.19
Three-axle or more	4,400	0.56
Three-axles	2,100	0.51
Four axle	7,300	0.62
Four-axle or more	50,200	0.94

Also Determine Design ESAL for 20 Year Design Period if the traffic using the pavement grows at an annual rate of 4%.

3. a) What are the stresses induced by volume changes in concrete pavements? Explain Warping Stresses. (4)

b) A pavement for a four-lane regional divided highway is to be designed to last 25 years. During the first year, the estimated two-way equivalent single-axle applications are 144,000. The expected traffic growth rate is 3.5%. The design reliability is 95%, and the overall standard deviation is 0.35. The initial serviceability, P_0, is expected to be 4.5, and the terminal serviceability, P_t, is 2.5. (16)

The PCC pavement is to be laid on a granular subbase material. Using the standard laboratory test on 28-day specimens, the average compressive strength $f'_c = 4{,}900$, and the average modulus of rupture for third-point loadings was 600 psi.

The drainage was judged to be fair and will be subject to moisture levels approaching saturation 10% of time. The pavement is being designed with jointed reinforced concrete with untied asphalt shoulders. The effective modulus of subgrade reaction (corrected for loss of support) $k = 110$ psi.

Determine the design thickness.
(Please Use the Tables, Equations and Nomograph attached with this question paper and attach the graphs with your answer sheet).

4. a) What is a Pozzolan? "Cement without fly ash is more effective for soil-cement or concrete", explain your views about this statement. (5)

b) What are the cracks that occur in cement treated layers? How the cracking can be controlled during design of pavements with cement treated layers? (8)

c) Discuss Work Program Development and Scheduling for highway maintenance and rehabilitation works. (7)

Section II

Answer any 3 (three) from the following 4 (four) questions.

5. a) What are the differences between roadways and railways? (5)

b) Why is uniformity of gauges important for a particular country? (7)

c) A locomotive with 8 driving axles is required to haul a train at 80 km/hour, the axle load of the driving wheels of the engine is 25 tonnes. The train is to run on a straight level track. Find the maximum permissible train load that the engine can pull. (8)

6. a) Show different types of rails in sketches. What are the advantages of flat footed rails? (7)

   b) What are the materials for cross-sleeper? Mention the important features of timber sleepers. What are the advantages and disadvantages of Concrete sleepers? (8)

   c) Determine the suitable rail section for a locomotive to carry axle load of 22.5 tonnes. (5)

7. a) State the requirements of an ideal material for ballast. (4)

   b) What are the materials normally used as ballast? Sketch three sections showing packing of ballast. (6)

   c) Calculate the width of actual expansion gap to be provided for a rail of 12.80 m length. The maximum rail temperature is 60°C and the temperature at the time of linking is 30°C. Use, $e = L \alpha t \times 10^3$, where the parameters have their usual meaning and $\alpha = 1.2 \times 10^{-5}$ per degree centigrade. (10)
   Also find out: number of rails, sleepers, fish-plates, fish-bolts, bearing-plates and dog-spikes per km of rail track, where rail is of 45 kg type and sleeper density is 15.8.

8. a) What are the advantages of good railway track maintenance? Discuss maintenance of railway bridges. (6)

   b) Curves of a railway track should be avoided in which locations? (4)

   c) A transition curve is to be used to join the ends of a 3.94° circular curve with the straight. The length of the transition curve is 120 m. Work out the shift and offsets at every 30 m interval. How will you set this transition cure? (10)
   $Y = X^3/6RL$, $S = L^2/24R$, where, the symbols have their usual meanings.

Equations:

1. $$T = \frac{(1+r)^n - 1}{r} \times T_1$$

2. $$W_{18} = D_D \times D_L \times \hat{w}_{18}$$

The parameters have their usual meanings

TABLE 20-10 Recommended Load-Transfer Coefficients for Various Pavement Type and Design Conditions

Shoulder	*Asphalt*		*Tied PCC*	
Load transfer devices	*Yes*	*No*	*Yes*	*No*
Pavement type				
1. Plain jointed and jointed reinforced	3.2	3.8–4.4	2.5–3.1	3.6–4.2
2. Continuously reinforced concrete pavement	2.9–3.2	N/A	2.3–2.9	N.A.

Source: AASHTO Guide for Design of Pavement Structures, American Association of State Highway and Transportation Officials, Washington, D.C. (1993).

TABLE 20-11 Recommended Values of Drainage Coefficient, C_d, for Rigid Pavement Design

	Percent of Time Pavement Structure Is Exposed to Moisture Levels Approaching Saturation			
Quality of Drainage	*Less Than 1%*	*1–5%*	*5–25%*	*Greater T 25%*
Excellent	1.25–1.20	1.20–1.15	1.15–1.10	1.10
Good	1.20–1.15	1.15–1.10	1.10–1.00	1.00
Fair	1.15–1.10	1.10–1.00	1.00–0.90	0.90
Poor	1.10–1.00	1.00–0.90	0.90–0.80	0.80
Very poor	1.00–0.90	0.90–0.80	0.80–0.70	0.70

Source: AASHTO Guide for Design of Pavement Structures, American Association of State Highway and Transportation Officials, Washington, D.C. (1993).

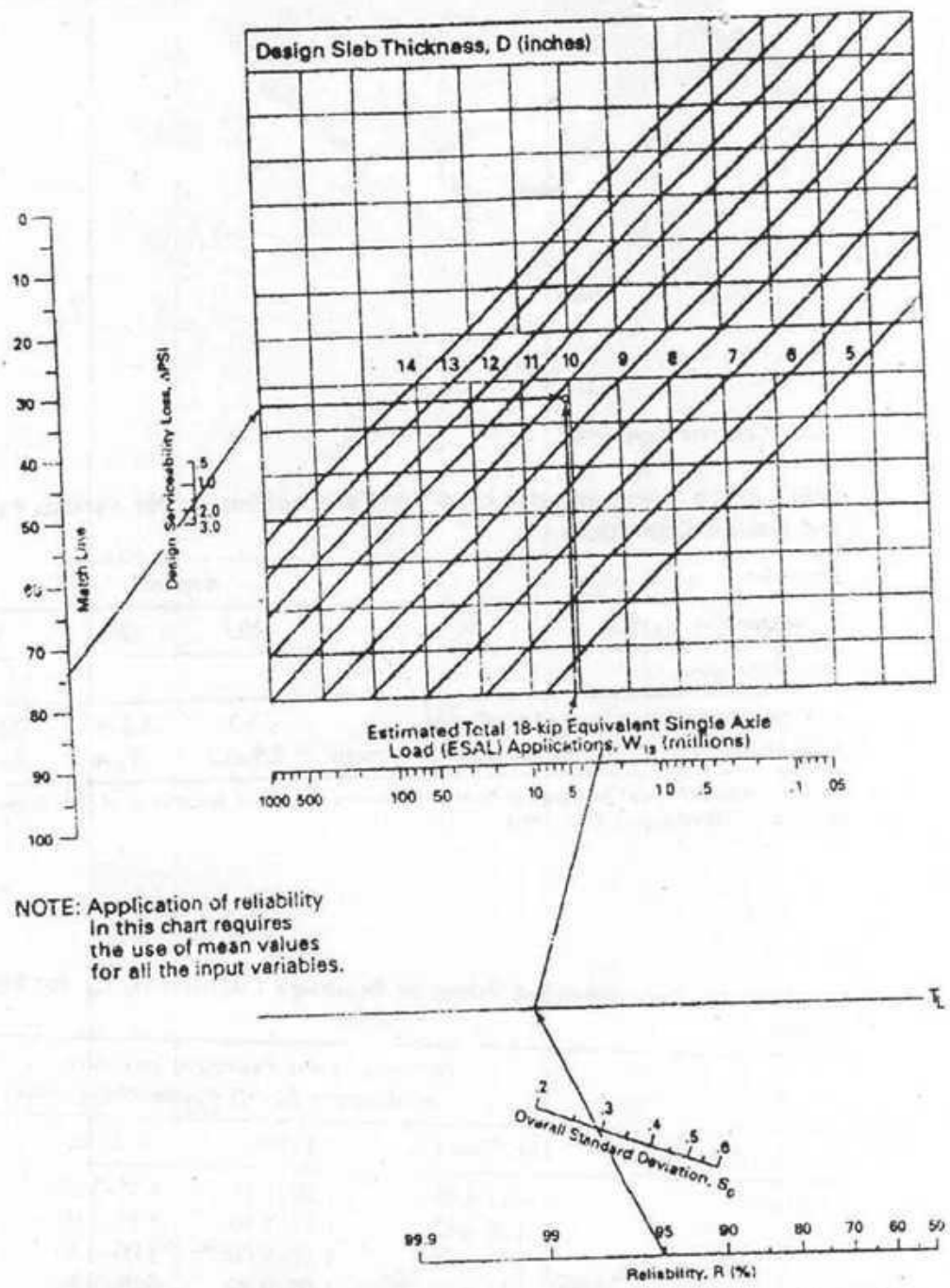


FIGURE 20-13 (Cont.) Design chart for rigid pavement design based on using mean values for each input variable, Segment 2. (Courtesy American Association of State Highway and Transportation Officials.)

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2013
Program: B.Sc Engineering (Civil)

Course Title: Irrigation and Flood Control; Course Code: CE 461; Credit hrs: 3
Time: 3 hours Full Marks: 150

Part A
Answer question no. 4 and any Two from the rest
(Assume any reasonable data if not given)

1. a) What are the Advantages of Irrigation? **(5)**

   b) A channel is to be designed for irrigating 6000 hectares in Kharif crop and 5000 hectares in Rabi crop. The water requirement for Kharif and Rabi are 70 cm and 30 cm, respectively. The base period for Kharif is 4 weeks and for Rabi is 5 weeks. Determine the discharge of the channel for which it is to be designed. **(10)**

   c) Determine the time required to irrigate a strip of land of 0.05 hectares in area from a tube-well with a discharge of 0.03 cumec. The infiltration capacity of the soil may be taken as 5 cm/h and the average depth of flow on the field as 10 cm. Also determine the maximum area that can be irrigated from this tube well. **(10)**

2. a) Differentiate between Alluvial and non-alluvial Canal. **(4)**

   b) What are the advantages of canal lining? Write the distribution system for Canal Irrigation. **(2+4)**

   c) What is Launching Apron? Describe the Design procedure of a Launching Apron. **(2+5)**

   d) A canal of 5 km length having discharge capacity of 3.5 cumec is proposed to be lined with boulder lining. The total cost of lining is estimated as 4 lakhs. The life of lining is considered as 60 years. Justify the lining in the canal from the following data. **(8)**

Rate of interest	= 8 %
Seepage loss	= 2 %
Revenue for irrigation water	= Tk. 75 per hect-m
Maintenance cost per Km for lined canal	= Tk. 1000
Maintenance cost per Km for unlined canal	= Tk. 2500
Base period of crop	= 120 days
Additional benefit/Km	= Tk. 1000

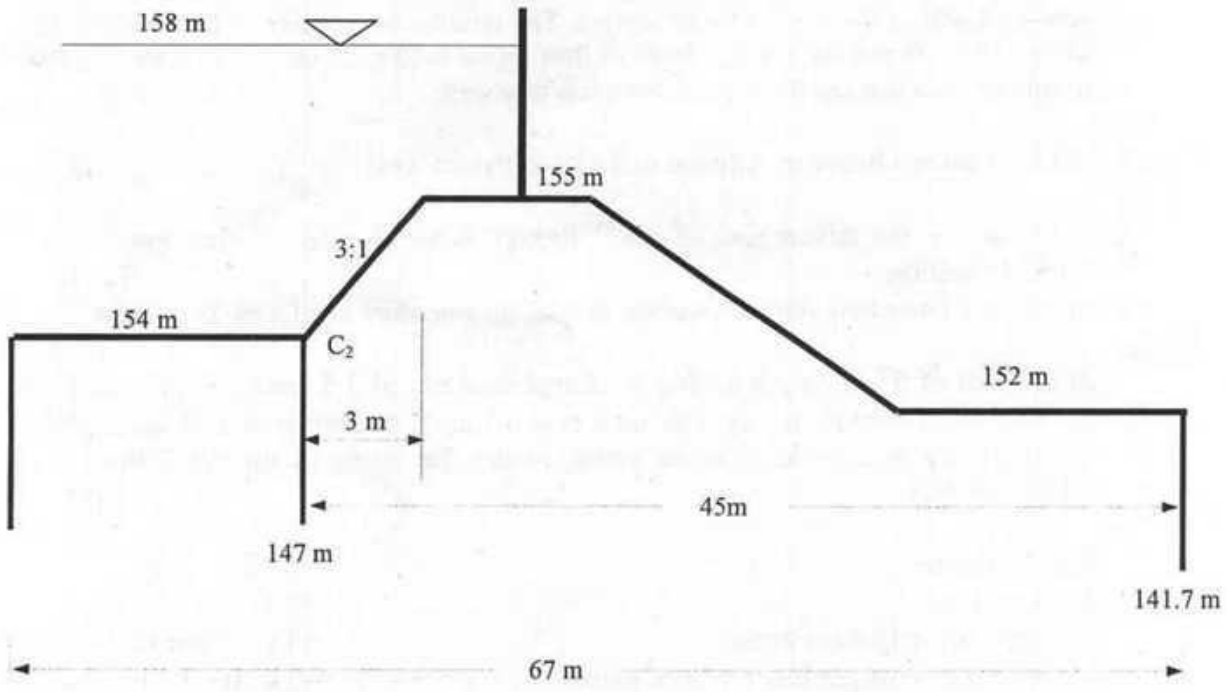
3. a) What is Silt Regulation Works? Write Different types of Silt Regulation Works. **(2+2)**

b) What are the differences between spur and Groyne? What kind of spur you are Going to propose for the following condition? a) Attracting b) Deflecting **(2+4)**

c) What are the different types of pumps that can be used for irrigation? Describe Briefly the pump characteristics curve. **(3+4)**

d) A centrifugal pump is required to lift water. The brake horse power of the engine is 20. The water is directly supplies to the field channel. Suction head = 7 m, Coefficient of friction = 0.01, Efficiency of pump = 60%, Diameter of pipe = 18 cm. calculate the flow Rate. **(8)**

4. Using the Khosla's curves, determine the following for the apron shown below:
   a) If percentage of pressure at C_2 is 56%, what will be the percentage of pressure at this point after corrections due to pile interference and slope
   b) Find exit gradient where, corrections factor for slope, 3:1 = 4.5,
      Assume floor thickness = 1 m. **(25)**



Part- B

There are **four questions**. Answer **any three.**

1. (a) Differentiate between the following terms : **(2x3=6)**
   i. Capillary water and hygroscopic water
   ii. Moisture content by mass and moisture content by volume.

   (b) Describe briefly the working principle of a tensiometer with a neat sketch. Also state its limitations. **(8+2=10)**

   (c) A stream of 140 liters per second was diverted from a canal and 105 liters per second were delivered to the field. An area of 1.5 hectares was irrigated in 8 hours. The effective depth of root zone was 1.5 m. The runoff loss in the field was 350 m^3. The depth of water penetration varied linearly from 1.7 m at the head end of the field to 1.1 m at the tail end. Available moisture holding capacity of the soil is 20 cm per meter depth of soil. Determine
   i. water application efficiency
   ii. water storage efficiency and
   iii. water distribution efficiency.

   Irrigation was started at a moisture extraction level of 50% of the available moisture. **(9)**

2. (a) List the climatic factors affecting evapotranspiration. Describe the principle of non-weighing percolation type lysimeter for measuring the rate of evapotranspiration. **(4+8=12)**

   (b) Wheat has to be grown at a certain place, the useful climatological conditions of which are tabulated below. Determine the evapo-transpiration and consumptive irrigation requirement of wheat crop. Also determine the field irrigation requirement if the water application efficiency is 80%. Use Blaney-Criddle equation and a crop factor is 0.8. **(8)**

Month	**Monthly temperature (^oC) averaged over the last 5 years**	**Monthly percent of day time hour of the year computed from the Sun-shine**	**Useful rainfall in cm averaged over the last 5 years**
Nov	19.0	7.40	1.75
Dec	16.0	7.15	1.42
Jan	14.5	7.25	3.01
Feb	13.5	7.10	2.75

   (c) Show the distribution system for Canal Irrigation in a neat sketch. **(5)**

3. (a) Write short note on the following items: **(2x3=6)**
   iv. Contour canal
   v. Pumping head
   vi. Multi-stage pump.

(b) The culturable commanded area of a watercourse is 1200 hectares. Intensities of sugarcane and wheat crops are 30% and 40% respectively. The duties for the crops at the head of the watercourse are 780 hectares/cumec and 1700 hectares/cumec respectively. Find **(11)**

(i) The discharge required at the head of the watercourse
(ii) The design discharge at the outlet, assuming a time factor equal to 0.8

(c) Show the components of a centrifugal pump in a neat sketch. Deriver the following relation to describe the effect of Speed on the performance of a centrifugal pump.

$$\frac{n}{n_1} = \frac{Q}{Q_1} = \sqrt{\frac{H}{H_1}} = \sqrt[3]{\frac{P}{P_1}}$$ **(3+5=8)**

4. (a) Show a typical layout of the diversion head works. Also write down the functions of the following components:

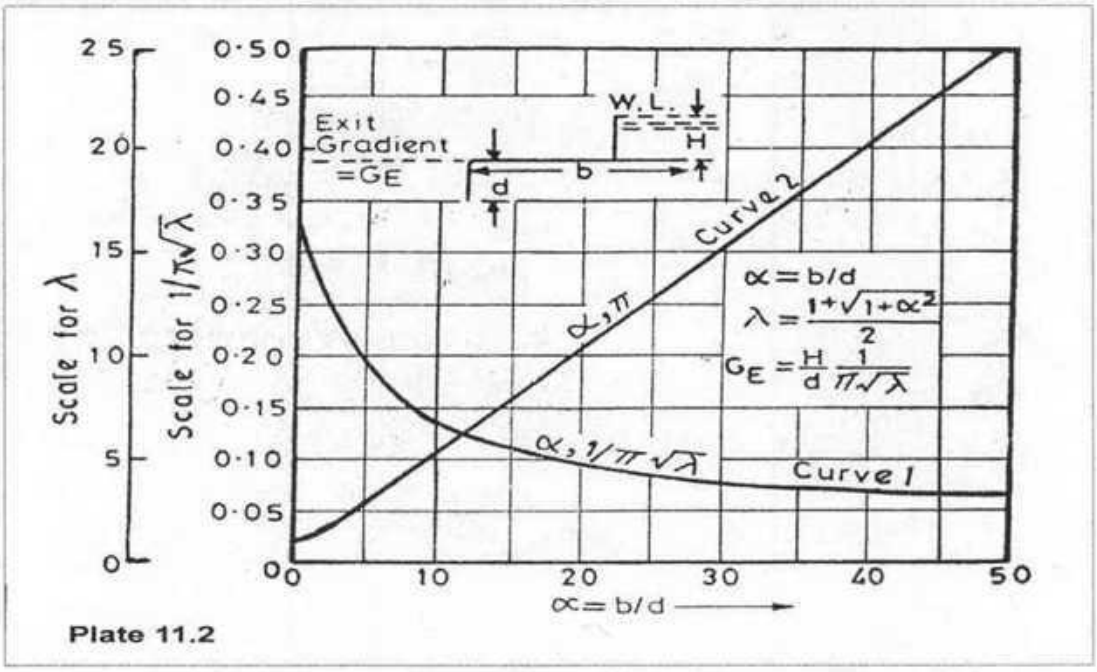
(i) Under-sluice
(ii) Fish ladder. **(5+4=9)**

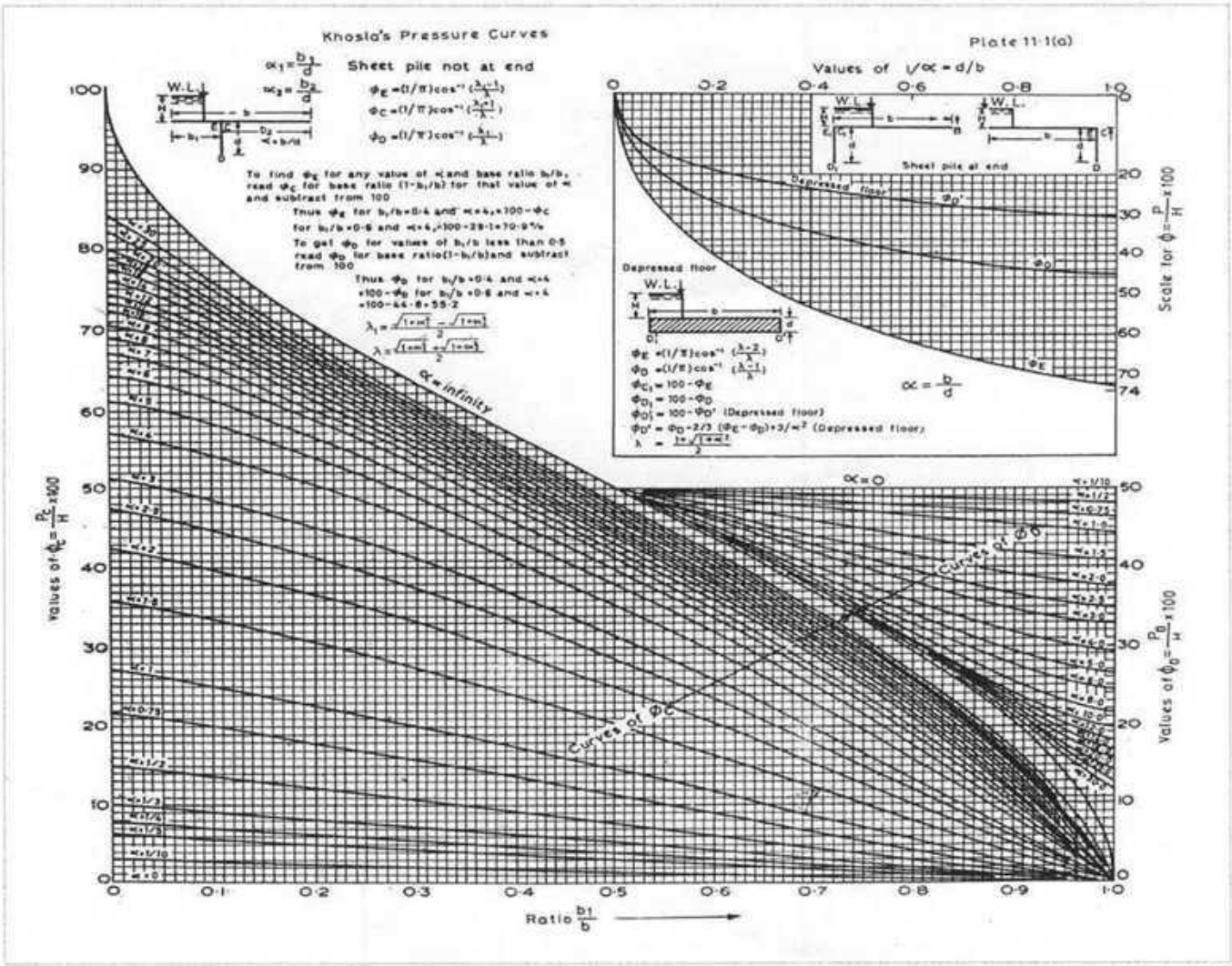
(b) Explain rigid module with a neat sketch. Show that 'flexibility' of an outlet structure is given by

$$F = \frac{m}{n}\frac{y}{H}$$ **(4+6=10)**

(C) Distinguish between the following terms:

(i) Aqueduct and syphon aqueduct
(ii) Weir and barrage. **(2x3=6)**


Scale for λ
Scale for 1/π√λ
Exit Gradient =GE
W.L.
H
b
d
Curve 2
Curve 1
α, π
α, 1/π√λ
α = b/d
λ = (1+√(1+α²))/2
GE = H/d · 1/π√λ
α = b/d
Plate 11.2


Khosla's Pressure Curves
Plate 11·1(a)
Sheet pile not at end
Values of 1/α = d/b
Sheet pile at end
Depressed floor
Scale for Φ = P/H x100
Values of Φ = P/H x100
α = infinity
α = 0
Curves of Φ'
Curves of Φ
Ratio b1/b
α = b/d

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2013
Program: B. Sc. Engineering (Civil)

Course Title: Chemistry | Course Code: CHEM 111
Time: 3 Hours | Full Marks: 150

Section-A

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

1. a) Explain the terms Cp and Cv. (3+5+5=13)
Establish the relation between Cp and Cv.
Three moles of an ideal gas ($Cv = 5$ cal deg^{-1}. mol^{-1}) at 10.0 atm and 0 °C are converted to 2.0 atm at 50 °C. Find ΔE and ΔH for the change.
($R = 2$ cal.mol^{-1}.deg^{-1})

b) What is meant by "bond energy"? (4+4+4=12)
Explain "thermo chemical equation" with suitable examples.
Given that energies for H–H, O=O and O–H bonds are 104, 118 and 111 kcal mol^{-1}, respectively. Calculate the heat of reaction of the following reaction:
$H_2(g) + ½\ O_2(g) \rightarrow H_2O(g)$

2. a) What is reaction rate? (3+3+7=13)
How particle size of a solid reactant effects the reaction rate?
Discuss instantaneous, average and initial rates.

b) Differentiate between 'order' and 'molecularity'. (5+4+3=12)
Why high molecularity is rate?
How molecularity of the complex reaction: $2\ N_2O_5 \rightarrow 4NO_2 + O_2$ can be determined?

3. a) Discuss that 'chemical equilibrium' is a state of a reversible system. (7+6=13)
Derive mathematically the "law of mass action".

b) What are Kp, Kc and Kx ? How are they related ? (3+5+4=12)
At 100 °C, PCl_5 dissociates to 35%. If total pressure is 1.5 atm, find Kp and Kc.

4. Write note on: (12½ x 2 = 25)
a) Bomb calorimeter
b) Half-lives of reactions

Section-B

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

5. a) What is D_2O? (2+5+6=13)

Compare the physical properties of D_2O and H_2O.
Draw the associated structure, Lewis structure and tetrahedral geometry of H_2O molecule.

b) Explain the chemical value of the solvent property of water : (6+6=12)
i) For the reaction with NaCl(s) and NaCl(aq)
ii) For the dissolution of C_{12} $H_{22}O_{11}$ and AgF

6. a) Sketch a physical view for a heterogeneous solution of a solid in solid. (2+6+5=13)
Distinguish between the physical solution, chemical solution and suspension.
Discuss the effect of external stresses on the dynamic equilibrium of a saturated solution.

b) What meant by super-saturation ? (2+4+6=12)
How it can be obtained for a solid in water ?
Explain the effects of temperature and pressure on the solubility of a solid in liquid.

7. a) Draw and explain a 'colloidal system'. (3+10=13)
How lyophobic colloids can be prepared by the 'colloidal mill' and 'peptization' methods?

b) Discuss the following properties of the colloids: (6+6=12)
i) Tyndall effect
ii) Brownian movement

8. a) Write note on : (12½ x 2 = 25)
i) Softening of water
ii) Formation of charged colloids

University of Asia Pacific

Department of Civil Engineering

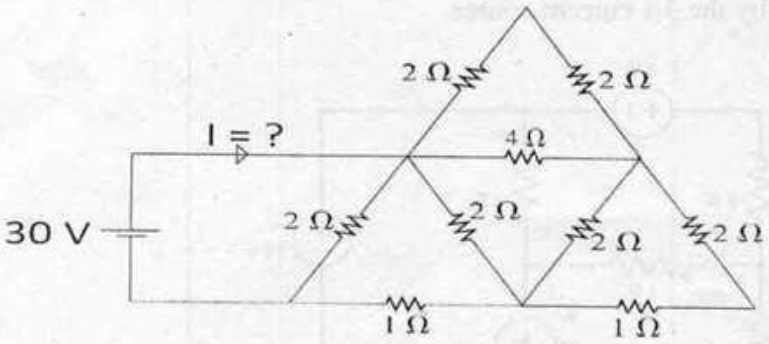
Semester Final Examination, Spring-2013

Program: B. Sc Engineering (2nd Year / 1st Semester)

Course Title: Basic Electrical Engineering Course No. ECE 201 Credits: 3.00
Time: 3.00 Hours. Full Marks: 150

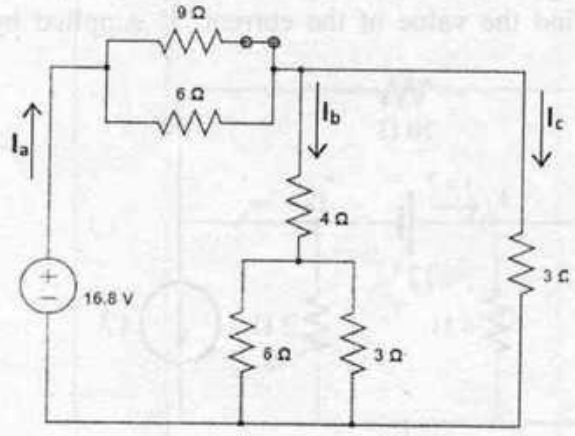
There are **Eight** Questions. Answer any **Six**. Figures in the right margin indicate marks.

01. (a) Determine the equivalent resistance seen by the 30 V source in the circuit shown below. Also determine the current 'I' supplied by the 30 V source. (7)



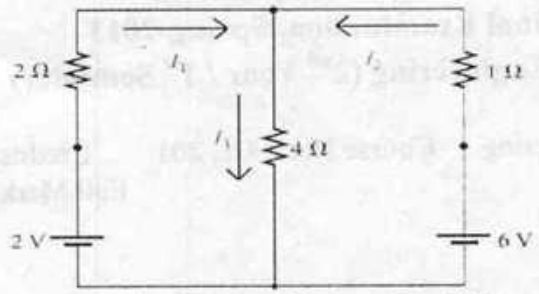
Circuit diagram for question 1(a)

(b) Find the currents I_a, I_b and I_c for the figure shown below. (9)



Circuit diagram for question 1(b)

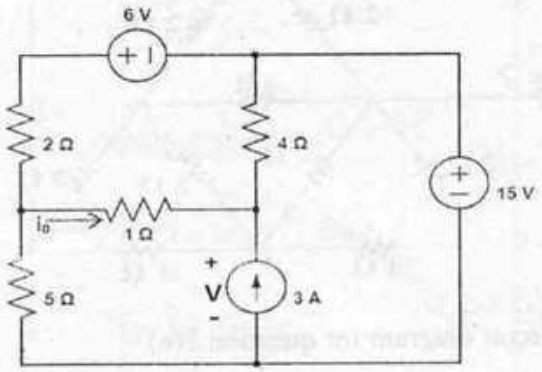
(c) Apply branch current analysis method to determine the currents I_1, I_2 and I_3 for the circuit shown below. (9)



Circuit diagram for question 1(c)

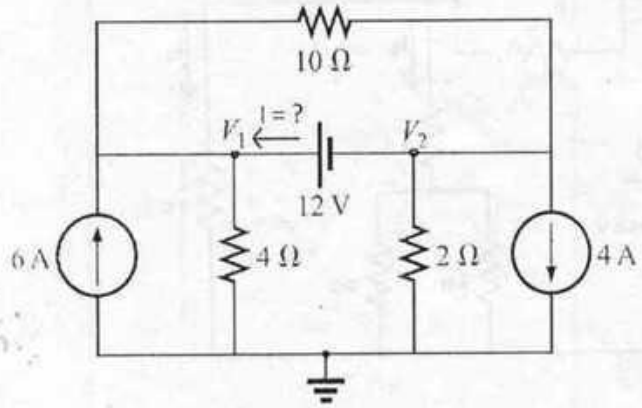
02. (a) Explain Ohm's law and Kirchoff's current law. (5)

(b) For the circuit shown below find the value of current i_0 and the voltage 'V' of the 3A current source using Superposition theorem. Also find the value of power generating / absorbing by the 3A current source. (20)



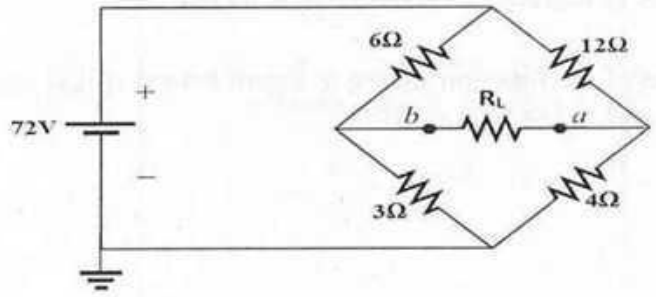
Circuit diagram for question 2(b)

03. (a) Determine the Nodal voltages V_1 and V_2 using the concept of super node, for the circuit shown below. Also find the value of the current 'I' supplied by the 12 V source. (12)



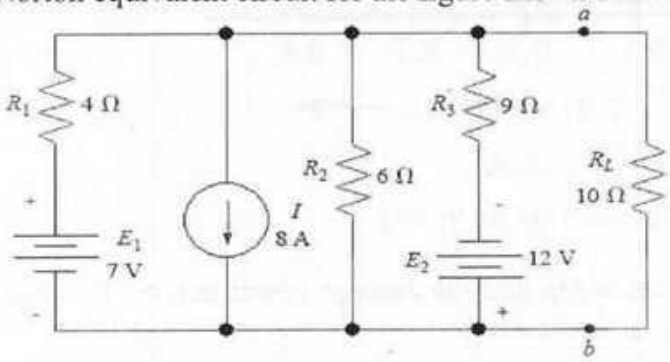
Circuit diagram for question 3(a)

(b) For the circuit shown below, find the Thevenin circuit seen by the R_L between points 'a' and 'b'. Then determine the value of R_L, so that maximum power can be transferred through R_L. Also determine the value of maximum power (13)



Circuit diagram for question 3(b)

04. (a) Find the Norton equivalent circuit for the figure shown below. (13)



Circuit diagram for question 4(a)

(b) Briefly discuss the following terms: (6*2)

Frequency, Time period, Power factor, Amplitude factor, Lenz's law, Fleming's Left Hand Rule.

05. (a) Describe the hysteresis loop of a ferromagnetic material. Explain it with a B-H curve. (13)

(b) For the magnetic circuit given below: (12)

(I) Find the value of I required to develop a magnetic flux of $2*10^{-4}$ Wb.
(II) Determine μ and μ_r for the material under these conditions.

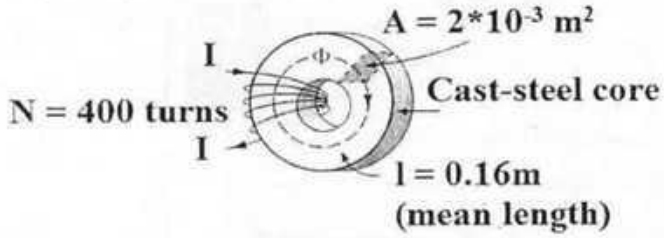


Figure for question 5(b)

06. (a) For an AC current $I = I_m \sin(\omega t)$, prove that, its r.m.s value is $I_{r.m.s} = I_m/(\sqrt{2}) = 0.707 * I_m$. (11)

(b) Prove that, average value of current of a rectified half wave is I_m/π. (7)

(c) Calculate the r.m.s value of the function shown in figure below, if it is given that for $0<t<0.1$, $y = 10(1-e^{-200t})$ and, $0.1<t<0.2$, $y = 10*e^{-100(t-0.1)}$. (7)

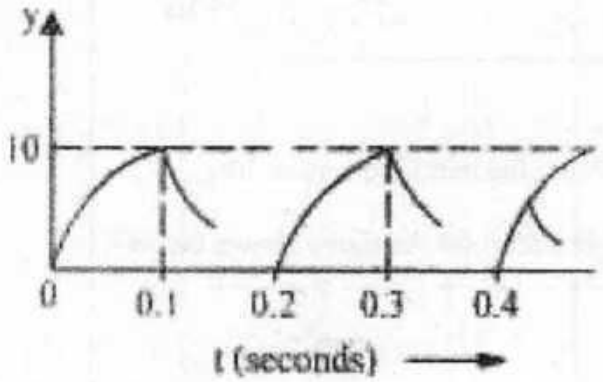


Figure for question 6(c)

07. (a) Determine the phase relationship and the average power delivered to networks having the following i/p voltage and current. (5*3)

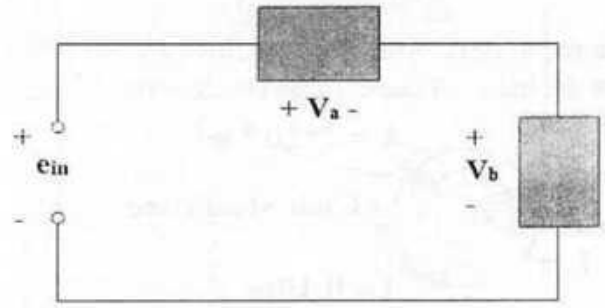
I) $v = 100\sin(\omega t+40^\circ)$, $i = 20\sin(\omega t+70^\circ)$

II) $v = 2\sin(\omega t+10^\circ)$, $i = -\sin(\omega t+30^\circ)$

III) $v = 3\sin(\omega t-150^\circ)$, $i = -2\cos(\omega t-60^\circ)$

(b) Find the input voltage of the circuit given below. If: (10)

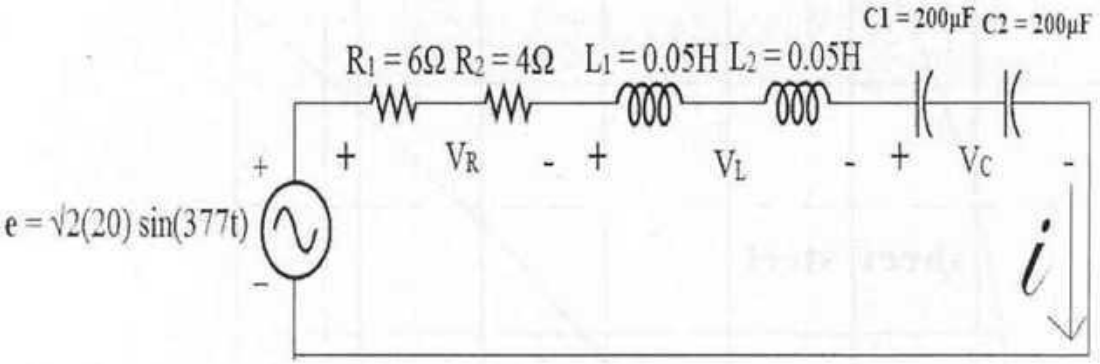
$$v_a = 20 \sin(377t + 70^\circ)$$
$$v_b = 30 \sin(377t + 45^\circ)$$



Circuit diagram for the question 7(b)

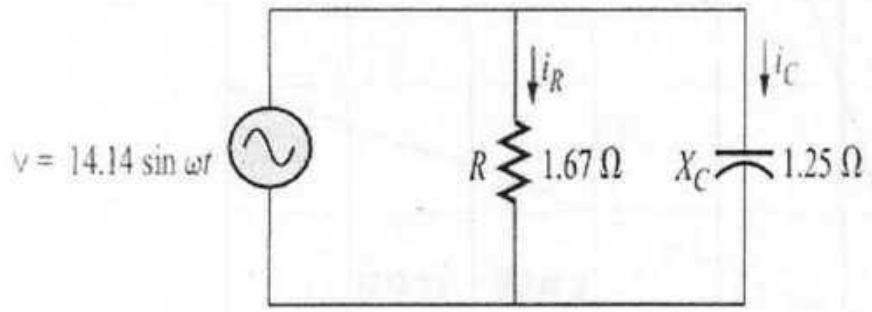
08. (a) For the circuit given below: (13)

(I) Calculate I, V_R, V_L and V_C in phasor form.
(II) Calculate the total power factor of the source.
(III) Calculate the total average power delivered by the source.

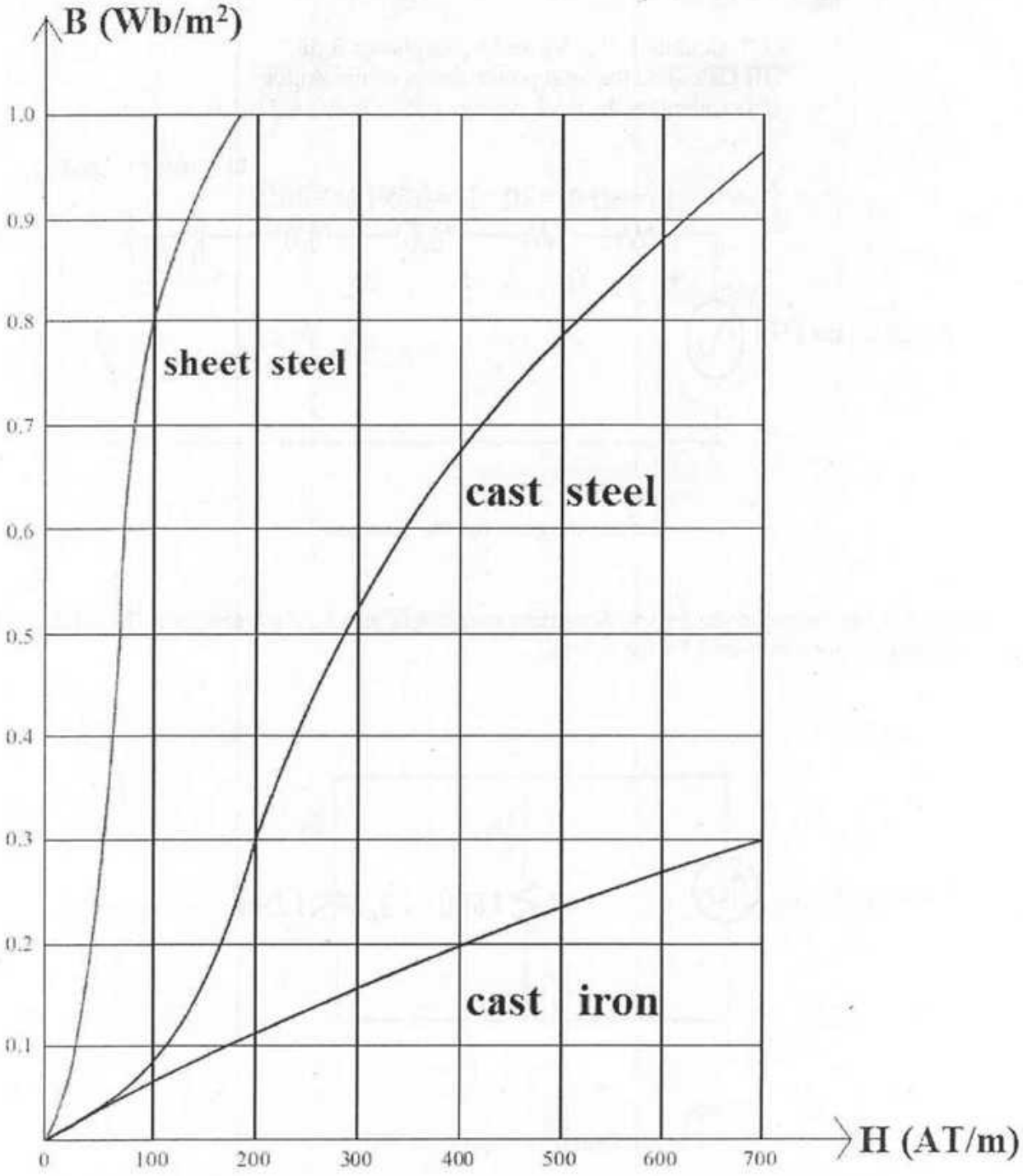


Circuit diagram for the question 8(a)

(b) For the circuit given below determine currents i_R and i_C. Also calculate the total average power delivered by the source. (12)



Circuit diagram for question 8(b)


B (Wb/m²)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
sheet steel
cast steel
cast iron
0
100
200
300
400
500
600
700
H (AT/m)

University of Asia Pacific
Department of Civil Engineering
Final Examination (Spring 2013)
Program: B.Sc. Engg ((2nd year 2nd semester)

Course Title : Principles of Economics **Credit Hours: 2.0** **Course : ECN 201**
Full marks : 50 **Time : 2 hrs**

(Answer any four questions from the following.)

Q.1. a. What are marginal cost and average cost? Graphically show the relationship between these two types of costs.

b. What are the causes behind economics and dis-economics of scale?

c. Differentiate between public and private finance. **(6+2.5+4)**

Q.2. a. What are the three methods of GDP measurement? Which components are excluded for measuring GDP?

b. What is the problem of double counting in measuring GDP? Explain a method for measuring GDP that avoids this problem? **(6.25X2)**

Q.3.a. Find the GDP deflator of the year 2010, 2011, and 2012.from the following table: (All figures are in Crore Taka)

Year	Nominal GDP	Real GDP
2010	1500	1095
2011	1940	1250
2012	2540	1845

b. Differentiate between nominal GDP and real GDP. **(9+3.5)**

Q.4. a. Graphically interpret how comparative advantage drives international trade.

b. What do you understand by 'Terms of Trade'? How do production structure and elasticity of demand and supply influence terms of trade of a country? **(6.25X2)**

Q.5. a. Explain the three motives behind people's desire to hold money.

b. How do real GDP and interest rate influence people's desire to hold money? Use appropriate graphs. **(6.25X2)**

Q.6. a. What is inflation? Explain how fiscal and monetary policies are used to curb inflation.

b. You deposit $2000 in the bank for one year.

CASE 1: inflation = 0%, nom. interest rate = 8%
CASE 2: inflation = 10%, nom. interest rate = 16%

1) In which case does the real value of your deposit grow the most?
2) Assume the tax rate is 25%. In which case do you pay the most taxes?
3) Compute the after-tax *nominal* interest rate and the *real interest rate.*

(4.5+8)

University of Asia Pacific

Semester Final Examination (Spring-2013)

Department of Civil Engineering

Course Code: HSS 101 Course Title: English Language I

Time: 3 Hours Full Marks: 50

*Marks are indicated in the right margin

* Answer all the questions on the separate answer script.

Section-A

1. *Read* the passage *carefully* and *then* answer the *corresponding questions*.

The world's oceans have warmed 50 percent faster over the last 40 years than previously thought due to climate change, Australian and US climate researchers reported Wednesday. Higher ocean temperatures expand the volume of water, contributing to a rise in sea levels that is submerging small island nations and threatening to wreak havoc in low-lying, densely-populated delta regions around the globe. The study, published in the British journal ***Nature***, adds to a growing scientific chorus of warnings about the pace and consequences rising oceans. It also serves as a corrective to a massive report issued last year by the Nobel-winning UN Intergovernmental Panel on Climate Change (IPCC), according to the authors. Rising sea levels are driven by two things: the thermal expansion of sea water, and additional water from melting sources of ice. Both processes are caused by global warming. The ice sheet that sits atop Greenland, for example, contains enough water to raise world ocean levels by seven metres (23 feet), which would bury sea-level cities from Dhaka to Shanghai. Trying to figure out how much each of these factors contributes to rising sea levels is critically important to understanding climate change, and forecasting future temperature rises, scientists say. But up to now, there has been a perplexing gap between the projections of computer-based climate models, and the observations of scientists gathering data from the oceans. The new study, led by Catia Dominguez of the Centre for Australian Weather and Climate Research, is the first to reconcile the models with observed data. Using new techniques to assess ocean temperatures to a depth of 700 metres (2,300 feet) from 1961 to 2003, it shows that thermal warming contributed to a 0.53 millimetre-per-year rise in sea levels rather than the 0.32 mm rise reported by the IPCC.

1.1 Choose the best answer: **5 × 0.5 = 2.5**

a. What happens when the ocean's temperature rises?
   i. It causes sea levels to rise. ii. It causes sea levels to remain constant.
   iii. It causes sea levels to decrease. iv. None of the above .

b. The rise in water levels is especially dangerous for small island nations and:

   i. Low-lying delta regions. ii. All coastal cities.

   iii. People who live on the beach. iv. People who live on landlocked region.

c. The new study:

i. Shows that thermal warming contributed to a 0.32 mm-per-year rise in sea levels.

ii. Did not reveal anything new to the scientists.

iii. Used new techniques to assess ocean temperatures.

iv. Reveals that human beings are on the verge of destruction.

d. Ultimately, the new study should help scientists to:

i. know about lowering water levels.

ii. better predict climate change.

iii. bury sea-level cities like Dhaka and Shanghai.

iv. stop the water pollution.

e. What was the main discovery of the study?

i. That not enough is being done about global warming.

ii. That ocean waters have warmed faster than scientists had previously thought.

iii. That the warming of the world's oceans is not a threat.

iv. Human civilization will come to an end under the rising sea-water.

1.2 Answer the question using no more than two sentences. **5 × 1 = 5**

a) What are the main factors responsible for the rising of sea level?
b) Why is it important to figure out how much each of these factors contributes to rising sea levels?
c) What is the difference found between the two studies of the rising of sea level conducted by IPCC and Catia Dominguez?
d) What will be the impact if the ice sheet over Greenland melts?
e) Who will be the possible victim of sea level rising?

Section B

2. Fill in *any three* of the blanks with appropriate parts of speech. **3 × 2 = 6**

1. An ---------- (ambition) person should have strong ---------- (determine).
2. You know they tried to ---------- (fool) the crowd first by ---------- (fright) Tom as a ghost.
3. ---------- (promise) to serve your country until your ---------- (dead).
4. Years later he still feels ---------- (shame) of his ---------- (misbehave).
5. Consumer's---------- (rely) on the internet for information can sometimes be ---------- (mislead).

3. Add either a prefix or a suffix with *any five* of the following words and make a sentence with each of the new words. **5 × 1 = 5**

trans-, em-, fore-,re-, im-,-ate, -ian- ic, -er,- ian,- or

pending, form, post, see, guard, rhythm, detect, consider, mature, bitter, new.

4. Fill in *any four* of the blanks with appropriate homophones conforming to their respective IPA transcriptions. **4 × 1 = 4**

i. Please ---------/ reɪz / the curtains and let in the ---------- / reɪz /of sun.

ii. The government has reclaimed some land to build_____ /præktis/ facility where soldiers will _____ /præktis/ shooting.

iii. The_____ /weðə(r)/ condition will decide _____/weðə(r) to resume the game or not.

iv. They_____ /haɪə(r)/ him as he is the player of _____ / haɪə(r)/standard.

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Vi The team ---------- / wʌn / because ---------- / wʌn / of their players played really well.

5. Write *two sentences* with *any four* of the following words and their homographs. **4 × 1 = 4**

Hide, lead, page, wind, poor, grave.

6. The following excerpt has some misspelled words. Trace them out and write them correctly.

10 × 0.25 = 2.5

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Section C

(Answer *any three* of the following questions. *Each question* carries *7 marks* each) **3×7= 21**

7. Compare and contrast between the sun and the moon. (250 words)

8. Write a paragraph narrating any of your adventures. (250 words)

9. Write a letter to your friend describing how you celebrated your last Eid vacation. (250 words)

10. Translate the following passage into English:

আমার বাবা ভ্রমণ করতে পছন্দ করেন । দেশ-বিদেশ, জানা-অজানা, চেনা-অচেনা শহরগুলো তাই এখন আমার শখে পরিণত হয়েছে । যদিও বাবার সুবাদে কিছুটা ভ্রমণের সুযোগ পেয়েছি কিন্তু জানার আছে অনেক কিছু । যান্ত্রিক সময়ে, কাজের অবসরে কোথাও ভ্রমণ করার ইচ্ছা পোষোণ করাটা কঠিন । কিন্তু আমার বাবা বলেন "তুমি তোমার সীমানা পেরিয়ে যত দূর যাবে, তোমার মনের পরিধি তত বড় হবে "। বাবার এই কথার বাস্তবতা আমি উপলব্ধি করতে পারি । তাই তো দেখতে, জানতে, শিখতে, সব বাধা পেরিয়ে, যেতে চাই সীমানার বাইরে ।

University of Asia Pacific

Semester Final Examination (Spring-2013)

Department of Civil Engineering

Course Code: HSS 101 Course Title: English Language I

Time: 3 Hours Full Marks: 50

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Section-A

1. *Read* the passage *carefully* and *then* answer the *corresponding questions*.

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iii. The_____ /weðə(r)/ condition will decide _____/weðə(r) to resume the game or not.

iv. They_____ /haɪə(r)/ him as he is the player of _____ / haɪə(r)/standard.

v. The _____ /maɪnə(r)/ has been suffering from some _____ / maɪnə(r)/ injuries in gas explosion since last year.

Vi The team ---------- / wʌn / because ---------- / wʌn / of their players played really well.

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University of Asia Pacific
Department of Civil Engineering
Semester Final Examination Spring-2013
Program: B.Sc Engineering (Civil)

Course Title: English Language II | Course Code: HSS 103
Time: 3.00 Hours | Full Marks: 50

1. Read the following passage and answer the questions that follow:

When you imagine the desert, you probably think of a very hot place covered with sand. Although this is a good description for many deserts, Earth's largest desert is actually a very cold place covered with ice: Antarctica. In order for an area to be considered a desert, it must receive very little rainfall. More specifically, it must receive an average of less than ten inches of precipitation—which is the amount of rain, sleet, hail, or snow that falls on the ground every year. Antarctica, the coldest place on earth, has an average temperature that usually falls below the freezing point. And because cold air holds less moisture than warm air, the air in Antarctica does not hold much moisture at all. This is evident in the low precipitation statistics recorded for Antarctica. For example, the central part of Antarctica receives an average of less than 2 inches of snow every year. The coastline of Antarctica receives a little bit more—between seven and eight inches a year. Because Antarctica gets so little precipitation every year, it is considered a desert.

The air over Antarctica is too cold to hold water vapor, so there is very little evaporation. Due to this low rate of evaporation, most of the snow that falls to the ground remains there permanently, eventually building up into thick ice sheets. Any snow that does not freeze into ice sheets becomes caught up in the strong winds that constantly blow over Antarctica.

Now, answer the following questions: **1×07=07**

1) What do we consider usually as a desert?
2) Why Antarctica does not hold much moisture?
3) What criterion is needed for an area to be considered a desert?
4) What is precipitation?
5) What is the statistics of precipitation in Antarctica?
6) What causes the thick ice sheets in Antarctica?
7) Which is actually world's largest desert? Why?

2. Rewrite any **ten (10)** of the following sentences using appropriate modal verbs: **0.5×10=05**

a) You are suggested not to blow horn loud while crossing a hospital.
b) I think I am obliged to attend the conference.
c) I have a strong obligation to meet my sister or she will be in trouble.
d) It is advised that you maintain time sincerely.
e) Rashed is able to play piano.
f) You are allowed to visit the patients during visiting hour.
g) Am I allowed to submit your assignment next week?
h) Perhaps I shall have my lunch outside today.
i) My Uncle had the ability to help me if he did not have lost his job.
j) You have the necessity to buy a laptop immediately.
k) A person is obliged to have a driving license to drive a car.

3. Join any **ten (10)** of the following pairs of sentences with appropriate **conjunctions** or **relative pronouns**: **0.5×10=05**

a) It rained a lot. We enjoyed our picnic.
b) Take some chocolate with you. You will get hungry on the journey.

c) I shall not let you go. You have to tell me where you are going.
d) The traffic was bad. We reached on time.
e) That was my favorite book. I lost it yesterday in the bus.
f) Listen carefully. You don't know what to do.
g) She bought a red bag. She bought a matching red shoe.
h) It was public holiday last Thursday. Most of the shops were shut.
i) There is my childhood friend. He now lives in Boston.
j) Habib is going home on Monday. He may go on Tuesday also.
k) The phone rang three times. It was dinner time.

4. Write single sentence definition any **five (05)** of the following: **01×05=05**

a) Wisdom (synonym) b) Electrician(negation) c) Glowworm (class)
d) Cardiologist(function) e) Planetarium(description)

5. Write an application to your Head of the Department seeking permission to arrange a day long workshop on preventing drug abuse. **05**

6. UAP will participate in the 'Inter University Debate Competition- 2013'. As the convener of UAP Debating Club, write a memorandum to this effect. **05**

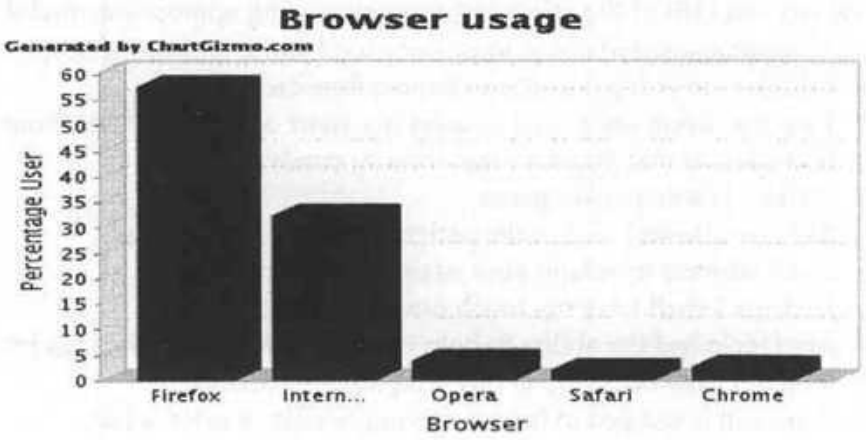
7. Your department has recently organized its annual Cultural Program. As a reporter of a national daily, write a news-report on the event for publication in your newspaper.

Or, A team from your department recently launched a fund for the street children. As the team leader, write a report to your registrar about the progress of the fund. **05**

8. Write a paragraph on any **one (1)** of the following (word limit 130) **08**

a) Your Last Eid Vacation b) A Place You dream to Visit

9. The bar chart below shows information about browser usage in Dhaka city. Describe and analyse in your own words the information available in the chart. **05**



University of Asia Pacific
Department of Civil Engineering
Semester Final Examination Spring-2013
Program: B.Sc Engineering (Civil)

Course Title: English Language II — Course Code: HSS 103
Time: 3.00 Hours — Full Marks. 50

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h) It was public holiday last Thursday. Most of the shops were shut.
i) There is my childhood friend. He now lives in Boston.
j) Habib is going home on Monday. He may go on Tuesday also.
k) The phone rang three times. It was dinner time.

4. Write single sentence definition any **five (05)** of the following: **01×05=05**

a) Wisdom (synonym) b) Electrician(negation) c) Glowworm (class)
d) Cardiologist(function) e) Planetarium(description)

5. Write an application to your Head of the Department seeking permission to arrange a day long workshop on preventing drug abuse. **05**

6. UAP will participate in the 'Inter University Debate Competition- 2013'. As the convener of UAP Debating Club, write a memorandum to this effect. **05**

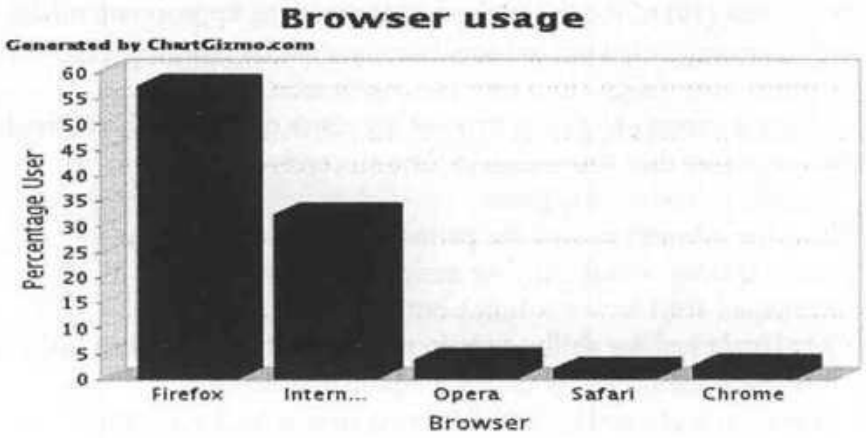
7. Your department has recently organized its annual Cultural Program. As a reporter of a national daily, write a news-report on the event for publication in your newspaper.

Or, A team from your department recently launched a fund for the street children. As the team leader, write a report to your registrar about the progress of the fund. **05**

8. Write a paragraph on any **one (1)** of the following (word limit 130) **08**

a) Your Last Eid Vacation b) A Place You dream to Visit

9. The bar chart below shows information about browser usage in Dhaka city. Describe and analyse in your own words the information available in the chart. **05**



University of Asia Pacific

Department Basic Sciences and Humanities

Semester Final Examination Spring-2013

Program: B. Sc Engineering (Civil)

(2nd Year 1st Semester)

Course Title: Bangladesh Studies: Society and Culture **Course Code: HSS 211(a)**

Credit: 2.00

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. Discuss the different types of marriage and family with examples. What are the major family functions?
2. Social survey is a familiar and popular method of research – discuss its necessary steps.
3. Describe the method of participant observation. Which method(s) is/are appropriate to study the society and culture of Bangladesh? Why?
4. What types of problems are faced by the urban people in the developing countries? What is the term Gerald Breese used for this vulnerable situation?
5. Discuss the economic arrangements of gathering, pastoral, horticultural and agricultural economy.

SECTION B

There are **THREE** questions in this section. Answer **ANY TWO** (2x10)

6. Define political institution. Discuss the general functions of a modern government.
7. Discuss the difference between monarchy and dictatorship with example.
8. Discuss the difference between capitalism, socialism and communism.

University of Asia Pacific

Department of Basic Sciences and Humanities
Semester Final Examination, Spring 2013
Programme: B.Sc. Engineering (Civil)
2nd year 1st semester

Course Title: Bangladesh Studies: History **Course Code: HSS 211(b)**
Credit: 2.00

Total Time: 2 Hours **Full Marks: 100**

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

SECTION A

There are **FIVE** questions in this section. Answer **ANY FOUR** (4 x 20)

1. Who were *Bara Bhuiyas*? Who defeated them and how?

2. What were the causes behind the *battle of Palashi*?

3. Briefly describe the reforms of *Raja Rammohon Roy*.

4. Why did Lord Carzon partition Bengal in 1905?

5. Describe the first phase of our *Language Movement*.

SECTION B

There are **THREE** topics in this section. Write short notes on **ANY TWO** (2 x 10)

6. Permanent Settlement

7. Lahore Resolution

8. Six points of Awami League

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring-2013
Program: B.Sc Engineering (Civil)

Course Title: Principles of Management | Course Code: IMG 301

Time: 2 hour | Full Marks: 100

Answer any 6 (Six) of the following questions. All questions are of equal value.

01. Define and explain management. How do the required managerial skills differ in the organizational hierarchy? What are the differences between productivity, effectiveness and efficiency?

02. Define objectives. Discuss the relationship between objectives and the organizational hierarchy. Describe MBO process.

03. Define & explain staffing. Discuss the functions of HRM. Identify the principles of HRM. .

04. What is organization? What do you mean by formal and informal organization? How authority is delegated and what are the processes of delegation.

05. What is Motivation? Discuss the model of motivation. State briefly Maslow's theory of motivation.

06. What is meant by controlling? Discuss the basic control process. State different types of budgetary and non-budgetary control devices.

07. What is ethics and business ethics? Discuss the factors influence ethical behavior. How would you encourage ethical behavior in business?

08. Write short note on any four of the following:

(a) Decision making, (b) TOWS Matrix (c) Leadership, (d) Time Management, (e) MIS.

University of Asia Pacific
Department of Basic Sciences and Humanities
Semester Final Examination, Spring 2013
Program : B.Sc Engineering (Civil, 1st year/1st semester)

Course Title : Mathematics I — Course Code: MTH 101
Time: 3 Hours — Full Marks: 150

N.B.: Answer 6 questions taking any 3 questions from each group. Figures in the right margin indicate the marks of the respective questions.

GROUP-A

Q1. (a) State and prove Rolle's theorem. 12.5

(b)Verify this theorem for the function $f(x)=(x-2)^2+2$ on (0, 4). 12.5

Q2. (a) State and prove Lagrange's Mean value theorem (MVT). 12.5

(b) Verify this theorem for $f(x)=x^3-x-4$ on the interval [-1, 2]. 12.5

Q3. (a) Find the nth derivative of $f(x)=\sin(ax+b)$ 8

(b) State and prove Leibnitz's theorem. 8

(c) If $y=(\sin^{-1}x)^2$ then show that 9

$$(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-n^2y_n=0.$$

Q4. (a) Let $f(x)=1-4x-x^2$. 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 $f(x)=x^4-8x^3+22x^2-24x+5$. 12.5

GROUP-B

Q5. (a) State Taylor's theorem with remainder. Use Taylor's theorem to expand $f(x)=\cos x$ in powers of x with the remainder term. 12.5

(b) State and prove L'Hospital's rule. Apply this rule to evaluate 12.5

$$\lim_{x\to 1}\left(\frac{\tan x-\sin x}{2x^3}\right).$$

Turn Over

Q6. Integrate the following 25

(i) $\int \frac{\sqrt{x}}{\sqrt{a^3 - x^3}} dx$ (ii) $\int \frac{dx}{\left(e^x + e^{-x}\right)^2}$ (iii) $\int \frac{\sin x \cos x}{\cos^4 x + \sin^4 x} dx$

(iv) $\int \frac{dx}{2x^2 + x + 1}$ (v) $\int \cos^7 x \, dx$

Q7. (a) State the fundamental theorem of calculus. 5

(b) Evaluate (i) $\int_0^{\frac{\pi}{2}} \frac{dx}{5 + 4\cos x}$ (ii) $\int_0^1 \frac{dx}{3 + x^2}$. 20

Q8. (a) Find the area of the region enclosed by the curves $y^2 = 8x$ and $x^2 = 8y$. 9

(b) Find the area of the region bounded by $x^2 = y$, $x = y - 6$. 8

(c) Find the area of the region bounded by $x = y^2$, $y = 2x - 2$. 8

University of Asia Pacific
Department of Basic Sciences and Humanities
Semester Final Examination, Spring 2013
Program : B.Sc Engineering (Civil, 1st year/1st semester)

Course Title : Mathematics I | Course Code: MTH 101
Time: 3 Hours | Full Marks: 150

N.B.: Answer 6 questions taking any 3 questions from each group. Figures in the right margin indicate the marks of the respective questions.

GROUP-A

Q1. (a) State and prove Rolle's theorem. 12.5

(b)Verify this theorem for the function $f(x)=(x-2)^2+2$ on (0, 4). 12.5

Q2. (a) State and prove Lagrange's Mean value theorem (MVT). 12.5

(b) Verify this theorem for $f(x)=x^3-x-4$ on the interval [-1, 2]. 12.5

Q3. (a) Find the nth derivative of $f(x)=\sin(ax+b)$ 8

(b) State and prove Leibnitz's theorem. 8

(c) If $y=(\sin^{-1}x)^2$ then show that 9

$$(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-n^2y_n=0.$$

Q4. (a) Let $f(x)=1-4x-x^2$. 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 $f(x)=x^4-8x^3+22x^2-24x+5$. 12.5

GROUP-B

Q5. (a) State Taylor's theorem with remainder. Use Taylor's theorem to expand $f(x)=\cos x$ in powers of x with the remainder term. 12.5

(b) State and prove L'Hospital's rule. Apply this rule to evaluate 12.5

$$\lim_{x\to 1}\left(\frac{\tan x-\sin x}{2x^3}\right).$$

Turn Over

Q6. Integrate the following 25

(i) $\int \frac{\sqrt{x}}{\sqrt{a^3 - x^3}} dx$ (ii) $\int \frac{dx}{\left(e^x + e^{-x}\right)^2}$ (iii) $\int \frac{\sin x \cos x}{\cos^4 x + \sin^4 x} dx$

(iv) $\int \frac{dx}{2x^2 + x + 1}$ (v) $\int \cos^7 x \, dx$

Q7. (a) State the fundamental theorem of calculus. 5

(b) Evaluate (i) $\int_0^{\frac{\pi}{2}} \frac{dx}{5 + 4\cos x}$ (ii) $\int_0^1 \frac{dx}{3 + x^2}$. 20

Q8. (a) Find the area of the region enclosed by the curves $y^2 = 8x$ and $x^2 = 8y$. 9

(b) Find the area of the region bounded by $x^2 = y$, $x = y - 6$. 8

(c) Find the area of the region bounded by $x = y^2$, $y = 2x - 2$. 8

University of Asia Pacific
Department of Basic Sciences & Humanities
Semester Final Examination, Spring 2013
Program: B.Sc. Engineering (Civil, 1st Year/2nd Semester)

Course No.: MTH 103 Credits Hrs: 3.0 Course Title: Mathematics II
Full Marks: 150 Time: Three hours

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) Determine the angles α, β, γ which the vector $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ makes with the positive directions of the coordinate axes and show that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$. 13

(b) Prove that the diagonals of a parallelogram bisect each other. 12

Q2. (a) Find the angles between which the vector $\vec{A} = 3\hat{\imath} - 6\hat{\jmath} + 2\hat{k}$ makes with the coordinate axes. 13

(b) If $\vec{A} = A_1\hat{\imath} + A_2\hat{\jmath} + A_3\hat{k}$, $\vec{B} = B_1\hat{\imath} + B_2\hat{\jmath} + B_3\hat{k}$, *and* $\vec{C} = C_1\hat{\imath} + C_2\hat{\jmath} + C_3\hat{k}$ show that 12

$$\vec{A}\cdot(\vec{B}\times\vec{C}) = \begin{vmatrix} A_1 & A_2 & A_3 \\ B_1 & B_2 & B_3 \\ C_1 & C_2 & C_3 \end{vmatrix}.$$

Q3. Prove that $[\underline{l}\,\underline{m}\,\underline{n}][\underline{a}\,\underline{b}\,\underline{c}] = \begin{vmatrix} \underline{l}\cdot\underline{a} & \underline{l}\cdot\underline{b} & \underline{l}\cdot\underline{c} \\ \underline{m}\cdot\underline{a} & \underline{m}\cdot\underline{b} & \underline{m}\cdot\underline{c} \\ \underline{n}\cdot\underline{a} & \underline{n}\cdot\underline{b} & \underline{n}\cdot\underline{c} \end{vmatrix}$, hence deduce the value of $[\underline{a}\,\underline{b}\,\underline{c}]^2$. 25

Q4. Find the shortest distance between the lines determined by 25
$3x - 4y - z + 5 = 0 = 3x - 6y - 2z + 13$ and
$3x + 4y - 3z + 2 = 0 = 3x - 2y + 6z + 17$.

SECTION B

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

Q5. (a) A particle moves along the curve $x = 2t^2, y = t^2 - 4t, z = 3t - 5$, where t is the time. Find the components of its velocity and acceleration at time $t = 1$ in the direction $\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$. 13

(b) If $\phi(x,y,z) = xy^2z$ *and* $\vec{A} = xz\hat{\imath} - xy^2\hat{\jmath} + yz^2\hat{k}$, find $\frac{\partial^3}{\partial x^2\partial z}(\phi\vec{A})$ at the point $(2,-1,1)$. 12

[Turn over]

Q6. (*a*) Prove that $\nabla^2\left(\frac{1}{r}\right) = 0$. 13

(*b*) Define Gradient, Divergence and Curl with example. 12

Q7. If $\vec{A} = (3x^2 + 6y)\hat{\imath} - 14yz\hat{\jmath} + 20xz^2\hat{k}$, evaluate $\int_C \vec{A} \cdot d\vec{r}$ from (0, 0, 0) to (1, 1, 1) along the following paths C: 25

(a) $x = t, y = t^2, z = t^3$.

(b) the straight lines from (0, 0, 0) to (1, 0, 0), then to (1, 1, 0), and then to (1, 1, 1).

(c) the straight line joining (0, 0, 0) and (1, 1, 1).

Q8. State Green's theorem? Verify Green's theorem in the plane for 25
$\oint_C [(xy + y^2)dx + x^2dy]$ where C is the closed curve of the region bounded by $y = x$ *and* $y = x^2$.

University of Asia Pacific
Department of Basic Sciences and Humanities
Semester Final Examination, Spring 2013
Program : B.Sc Engineering (Civil, 2nd year/1st semester)

Course Title : Mathematics III
Time: 3 Hours

Course Code: MTH 201
Full Marks: 150

Section- A

Answer any 3 (Three) of the following questions:

1. (a) Define basis and dimension. Let U be the subspace of R^3 spanned by the vectors $(1,2,1)$, $(2,1,-1)$ and $(7,-4,1)$. Find a basis and dimension of U. 13

(b) Find the rank of the matrix A where 12

$$A=\begin{pmatrix}1 & 3 & 1 & -2 & -3\\ 1 & 4 & 3 & -1 & -4\\ 2 & 3 & -4 & -7 & -3\\ 3 & 8 & 1 & -7 & -8\end{pmatrix}.$$

2. (a) Determine whether or not the following form a basis for the vector space R^3:
(i) $(1,1,1)$, $(1,2,3)$ and $(2,-1,1)$. (ii) $(1,1,2)$, $(1,2,5)$ and $(5,3,4)$. 10

(b) Let V and W be the following subspaces of R^4.

$$V=\{(a,b,c,d): b-2c+d=0\}$$
$$W=\{(a,b,c,d): a=d,\quad b=2c\}$$

Find a basis and the dimension of (i) V (ii) W and (iii) $V\cap W$. 15

3. (a) Define the kernel and the image of a linear transformation. Let $T: R^4 \to R^3$ be a linear transformation defined by

$$T(x,y,s,t)=(x-y+s+t,\ x+2s-t,\ x+y+3s-3t).$$

Find a basis and the dimension of the kernel of T and the image of T. 15

(b) Let S and T be the linear operators on R^2 defined by $S(u,v)=(0,u)$ and $T(u,v)=(u,0)$. Show that $TS=0$ but $ST\neq 0$. Also show that $T^2=T$. 10

4. (a) Define eigenvalues and eigenvectors. Determine the eigenvalues of the matrix 15

$$A=\begin{pmatrix}1 & 1 & 2\\ 0 & 2 & 2\\ -1 & 1 & 3\end{pmatrix}$$

(b) Let S and T be the linear operators of R^2 into R^2 defined by $S(u,v)=(3u+2v,-6u+v)$ and $T(u,v)=(2u+v,u-v)$. Find (i) $(ST)(u,v)$ (ii) $S^2(u,v)$ 10

Turn Over

Section- B

Answer any 3 (Three) of the following questions:

5. (a) What do you know about mean, median and mode? 10

(b) In an examination of 675 candidates the examiner supplied the following information:

Marks obtained	No. of candidates
Less than 10%	7
Less than 20%	39
Less than 30%	95
Less than 40%	201
Less than 50%	381
Less than 60%	545
Less than 70%	631
Less than 80%	675

Calculate the mean, mode and median of the percentage marks obtained. 15

6. (a) What is variance and standard deviation? Compute the standard deviation for the following frequency distribution. 15

Mass in Kg	60-62	63-65	66-68	69-71	72-74
No. of students	5	18	42	27	8

(b) What do you know about permutation and combination? Suppose 7 female and 5 male applicants have been successfully screened for 4 positions. In how many ways can the following compositions be selected? (i) 2 female and 2 males (ii) 4 females (iii) 4 people regardless of sex (v) At least 3 females. 10

7. (a) What do you mean by probability? A bag contains 5 white and 6 reds balls. Two balls are drawn successively at random from the bag. What is the probability that both the balls are white when the drawings are made (i) with replacement? and (ii) without replacement? 10

(b) A student takes his examination in four subjects A, B, C and D. He estimates his chances of passing in A as 4/5, in B as 3/4, in C as 5/6 and in D as 2/3. To qualify, he must pass in B and at least two other subjects. What is the probability that he qualifies? 15

8. (a) The probability that a contractor will get a plumbing contract is 2/3 and the probability that he will not get an electric contract is 4/9. If the probability of getting at least one contract is 3/5, what is the probability that he will get both? 5

(b) What do you know about binomial distribution and Poisson distribution? 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? 10

(c) A die is thrown 8 times and it is required to find the probability that 3 will show (i) Exactly 2 times (ii) At least seven times (iii) At least once. 10

The End

University of Asia Pacific
Department of Basic Sciences & Humanities
Semester Final Examination, Spring 2013
Program: B.Sc. Engineering (Civil, 2nd Year/2nd Semester)

Course No.: MTH 203 | Credits Hrs: 3.0 | Course Title: Mathematics IV
Full Marks: 150 | Time: Three hours

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. Find the Fourier transform of $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$ 25
and hence evaluate $\int_{-\infty}^{\infty} \frac{\sin sa \cos sx}{s} ds$.

Q2. (a) If $f(x) = e^{-x^2}$, find the Fourier cosine transform. 13

(b) Evaluate the Fourier sine transform of $f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2 - x & \text{for } 1 < x < 2. \\ 0 & \text{for } x > 2 \end{cases}$ 12

Q3. Find the Fourier transform of

(a) $f(x) = \begin{cases} \frac{1}{2\varepsilon}, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ 13

(b) $f(x) = \begin{cases} 1 - x^2, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ 12

Q4. Evaluate the finite Fourier sine and cosine transform of 13

(a) $f(x) = 2x,\ 0 < x < 4.$

(b) $f(x) = 1.$ 12

SECTION B

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

Q5. Find the Laplace transforms of the functions

(a) $F(t) = t^n.$ 13

(b) $F(t) = e^{at}.$ 12

Q6. (a) Solve the differential equation by using Laplace transform 13

$$y' + y = \sin t, \qquad y(0) = 1.$$

(b) Define Laplace transform. Find the Laplace transforms of the functions $F(t) = 1.$ 12

[Turn over]

Q7. (a) Solve the differential equation by using Laplace transform 13

$$y''(t) + y(t) = t, \qquad y(0) = 1, y'(0) = -2.$$

(b) Find the solution the differential equation by using Laplace transform: 12

$$\frac{dy}{dx} - 3y = 0, \qquad y(0) = 1.$$

Q8. (a) By using Laplace transform solve the differential equation: 13

$$x' - 5x = e^{5t}, \qquad x(0) = 0.$$

(b) Find the Laplace transforms of $7e^{2t} + 9e^{-2t} + 5\cos t + 7t^3 + 5\sin 3t + 2$. 12

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Spring - 2013
Program: B.Sc Engineering (Civil)

Course Title: Physics I | Course Code: PHY-101 | Credit: 3.00
Time: 3.00 Hours | Full Marks: 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) Show that the differential equation of a progressive wave is $\frac{d^2y}{dt^2} = v^2\frac{d^2y}{dx^2}$, where the symbols have their usual meanings. **15**

   (b) Show that for a particle executing simple harmonic motion, the acceleration at any instant is $a = -\omega^2 y$, where the symbols have their usual meanings. **10**

2. (a) What do you understand by interference of light waves? **05**

   (b) Describe the necessary conditions for constructive and destructive interference by deriving the intensity equation $I = 4a^2\cos^2\frac{\delta}{2}$. **20**

3. (a) Prove that the equation of Newton's formula for velocity of sound in gas is $V = \sqrt{\frac{P}{\rho}}$, where the symbols have their usual meanings. **15**

   (b) Discuss the effect of temperature on the velocity of sound in gas. **10**

4. (a) Derive the equation of Doppler effect when observer at rest and source in motion. **15**

   (b) A motor car sounding a horn at a frequency of 100 hertz moves away from a stationary observer towards a rigid flat wall with a velocity of 36 km/hr. How many beats per second will be heard by the observer? [The velocity of sound in air at room temperature = 350 m/s] **10**

[Turn over

SECTION B

There are **FOUR** questions. Answer any **THREE** Marks

5. (a) Derive the necessary conditions under which elliptically and circularly polarized light are formed by deriving the general equation of ellipse, $\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{2xy}{ab}\cos\delta=\sin^2\delta$. **15**

   (b) Show that at Brewster's angle the reflected and refracted rays are at right angles to each other. **10**

6. (a) Prove the law of Malus, $I \propto \cos^2\theta$, where the symbols have their usual meanings. **15**

   (b) Write short notes on half and quarter waveplate. **10**

7. (a) Show that the moment of inertia of a uniform circular disc is $\frac{1}{2}MR^2$, where the symbols have their usual meanings. **15**

   (b) Prove the perpendicular axes theorem for a plane lamina $I_Z = I_Y + I_X$, where the symbols have their usual meanings. **10**

8. (a) Show that the moment of inertia of a uniform rod is $\frac{1}{12}ML^2$, where the symbols have their usual meanings. **15**

   (b) Derive the following relations: angular momentum $L = I\omega$ and torque $\tau = I\alpha$, where the symbols have their usual meanings. **10**