University of Asia Pacific
Department of Civil Engineering
Final Examination (Spring 2014)
Program: B.Sc. Engg (3rd year 1st semester)

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

Part-A

(Answer any one from the following questions)

Q.1. Financial information for Westphal Tool Company is presented below.

WESTPHAL TOOLCOMPANY
Balance Sheets
December 31, 2012

	2012	2011
Assets		
Current assets		
Cash and cash equivalents	60,100	64,200
Short-term Investment	54,000	50,000
Accounts receivable (net)	107,800	102,800
Inventories	123,000	115,500
Total current assets	**344,900**	**332,500**
Property, plant, and equipment (net)	**625,300**	**520,300**
Total assets	**$970,200**	**$852,800**
Liabilities and Stockholders' equity		
Liabilities		
Current liabilities	203,500	187,400
Long-term liabilities	200,000	200,000
Total liabilities	**403,500**	**387,400**
Stockholders' equity		
Common stock	280,000	300,000
Retained Earnings	286,700	165,400
Total equity	**566,700**	**465,400**
Total liabilities and stockholders' equity	**$970,200**	**$852,800**

WESTPHAL TOOL COMPANY
Income Statement
For the Years Ended December 31 2012

	2012	2011
Sales	1,818,500	1,750,000
Less: Cost of goods sold	1,005,500	996,000
Gross profit	813,000	754,500
Less: Operating expenses (including tax)	617,000	575,000
Net income	$ 196,000	$ 179,500

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

a. Current Ratio
b. Acid test or quick ratio
c. Profit margin ratio.
d. Debt to total assets ratio.

(4X2.5=10+2.5)

Q.2.a. The bank statement for Laird Company shows a balance per bank of **$15,907.45** on April 30, 2012. On this date the balance of cash per books is **$11,589.45**.

Items to be reconciled:
Deposits in transit: April 30 deposit (received by bank on May 1). $2,201.40
Outstanding checks: 5,904
Errors: Laird wrote check no. 443 for $1,226 and the bank correctly paid that amount. However, Laird recorded the check as $1,262

Bank memoranda not recorded in book:
a. NSF check from J. R. Baron for $425.60
b. Charge for printing company checks $30
c. Collection of note receivable for $1,000 plus interest earned $50, less bank collection fee $15.

Instructions:
Prepare a bank reconciliation statement for the month of April. **(10)**

Q.2.b. Write down the basic accounting equation. What is dual effect on the equation? Explain with an example. **(2.5)**

Part-B

(Answer any two from the following questions)

Q.3. The following data has been taken from the records of Philips Ltd. for the year ended December 31, 2012.

Raw Material, 1/1/12	$47,000	Factory Insurance	$7,400
Raw Material, 31/12/12	44,200	Factory Machinery-Depreciation	7,700
Finished Goods, 1/1/12	85,000	Factory Utilities	12,900
Finished Goods, 31/12/12	77,800	Office Utilities Expense	8,600
Work in process, 1/1/12	9,500	Sales	475,000
Work in process, 31/12/12	8,000	Sales discount	2,500
Direct labor	145,100	Plant Manager's Salary	30,000
Indirect labor	18,100	Factory Property Taxes	6,100
Cash	28,000	Raw material purchases	67,500
Accounts Receivable	27,000	Factory repairs	800

Instructions:
a. Prepare a cost of goods manufactured schedule.
b. Prepare an income statement through gross profit. **(6.25X2)**

Q.4. Svetlana Pace is the advertising manager for Bargain Shoe Store. 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 $34,000 in fixed costs to the $270,000 currently spent. In addition, Svetlana is proposing that a 5% price decrease ($40 to $38) will produce a20% increase in sales volume (20,000 to 24,000). Variable costs will remain at $22 per pair of shoes. Management is impressed with Svetlana' s ideas but concerned about the effects that these 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 Svetlana's ideas are used.
b. Compute the margin of safety ratio for current operations and after Svetlana's changes are introduced. (Round to nearest full percent.)
c. Prepare a CVP income statement for current operations and after Svetlana's changes are introduced. Would you make the changes suggested? **(4+4+4.5)**

Q.5. Juanita Company must decide whether to make or buy some of its components. The costs of producing 50,000 electrical cords for its floor lamps are as follows

Direct Material	: $60,000
Direct Labor	: $30,000
Variable Overhead	: $12,000
Fixed Overhead	: $ 8,000
Total cost	: $110,000

Instead of making the electrical cords at an average cost per unit of $2.20 ($110,000/50,000), the company has an opportunity to buy the cords at $2.15 per unit. If the company purchases the cords, all variable costs and one-half of the fixed costs will be eliminated. That means two-thirds of the fixed costs will remain unchanged.

Instructions:

a. Prepare an incremental analysis showing whether the company should make or buy the electrical cords.
b. Will your answer be different if the released productive capacity will generate additional income of $25,000?
c. Will your answer be different if the released productive capacity will generate additional income of $1,000? **(8.5+2+2)**

Q.6. Hyung Corporation is considering investing in two different projects. It could invest in both, neither, or just one of the projects. The forecasts for the projects are as follows.

	Project A	**Project B**
Capital investment	$200,000	$300,000
Net annual cash flows	$50,000	$65,000
Length of project	5 years	7 years

The required rate of return acceptable to Hyung is 10%.

Instructions:

(a) Compute the net present value of the two projects.
(b) What capital budgeting decision should Hyung make?
(c) Project A could be modified. By spending $20,000 more initially, the net annual cash flows could be increased by $10,000 per year. Would this change Hyung's decision? **(8.5+2+2)**

TABLE 2 Present Value of $1

$$PV = \frac{\$1}{(1 + i)^n}$$

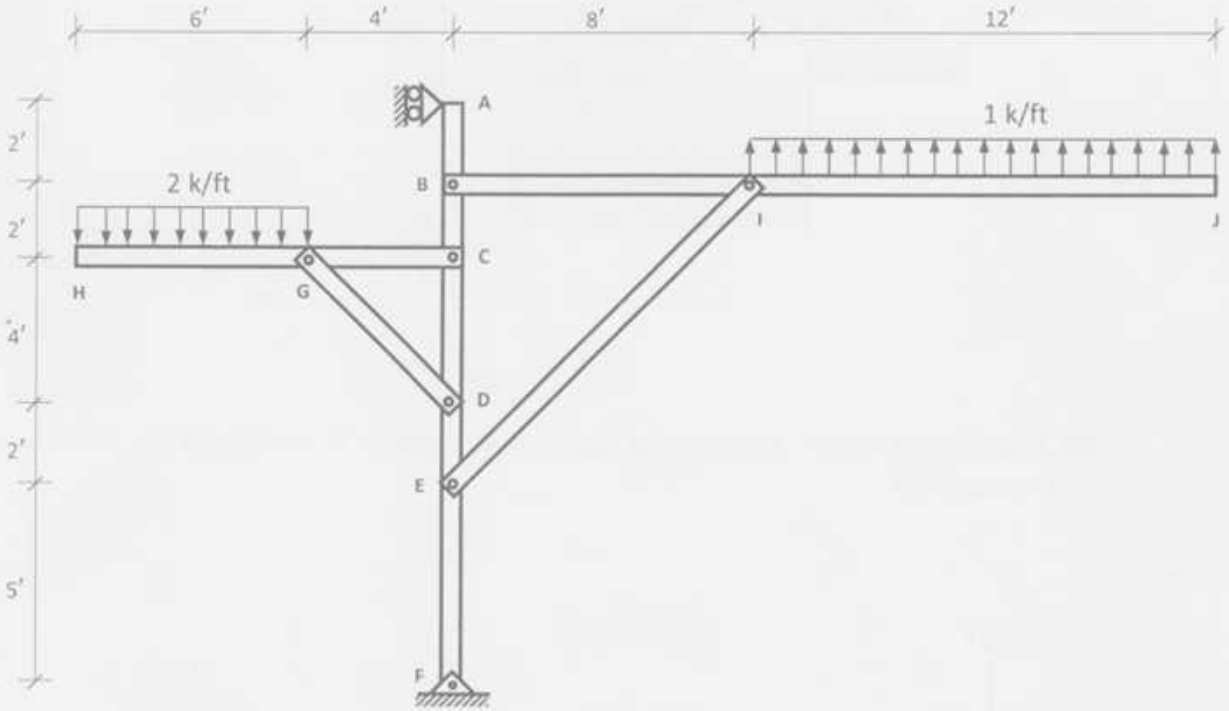
n/i	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	20.0%
1	0.99010	0.98522	0.98039	0.97561	0.97087	0.96618	0.96154	0.95694	0.95238	0.94787	0.94340	0.93458	0.92593	0.91743	0.90909	0.90090	0.89286	0.83333
2	0.98030	0.97066	0.96117	0.95181	0.94260	0.93351	0.92456	0.91573	0.90703	0.89845	0.89000	0.87344	0.85734	0.84168	0.82645	0.81162	0.79719	0.69444
3	0.97059	0.95632	0.94232	0.92860	0.91514	0.90194	0.88900	0.87630	0.86384	0.85161	0.83962	0.81630	0.79383	0.77218	0.75131	0.73119	0.71178	0.57870
4	0.96098	0.94218	0.92385	0.90595	0.88849	0.87144	0.85480	0.83856	0.82270	0.80722	0.79209	0.76290	0.73503	0.70843	0.68301	0.65873	0.63552	0.48225
5	0.95147	0.92826	0.90573	0.88385	0.86261	0.84197	0.82193	0.80245	0.78353	0.76513	0.74726	0.71299	0.68058	0.64993	0.62092	0.59345	0.56743	0.40188
6	0.94205	0.91454	0.88797	0.86230	0.83748	0.81350	0.79031	0.76790	0.74622	0.72525	0.70496	0.66634	0.63017	0.59627	0.56447	0.53464	0.50663	0.33490
7	0.93272	0.90103	0.87056	0.84127	0.81309	0.78599	0.75992	0.73483	0.71068	0.68744	0.66506	0.62275	0.58349	0.54703	0.51316	0.48166	0.45235	0.27908
8	0.92348	0.88771	0.85349	0.82075	0.78941	0.75941	0.73069	0.70319	0.67684	0.65160	0.62741	0.58201	0.54027	0.50187	0.46651	0.43393	0.40388	0.23257
9	0.91434	0.87459	0.83676	0.80073	0.76642	0.73373	0.70259	0.67290	0.64461	0.61763	0.59190	0.54393	0.50025	0.46043	0.42410	0.39092	0.36061	0.19381
10	0.90529	0.86167	0.82035	0.78120	0.74409	0.70892	0.67556	0.64393	0.61391	0.58543	0.55839	0.50835	0.46319	0.42241	0.38554	0.35218	0.32197	0.16151
11	0.89632	0.84893	0.80426	0.76214	0.72242	0.68495	0.64958	0.61620	0.58468	0.55491	0.52679	0.47509	0.42888	0.38753	0.35049	0.31728	0.28748	0.13459
12	0.88745	0.83639	0.78849	0.74356	0.70138	0.66178	0.62460	0.58966	0.55684	0.52598	0.49697	0.44401	0.39711	0.35553	0.31863	0.28584	0.25668	0.11216
13	0.87866	0.82403	0.77303	0.72542	0.68095	0.63940	0.60057	0.56427	0.53032	0.49856	0.46884	0.41496	0.36770	0.32618	0.28966	0.25751	0.22917	0.09346
14	0.86996	0.81185	0.75788	0.70773	0.66112	0.61778	0.57748	0.53997	0.50507	0.47257	0.44230	0.38782	0.34046	0.29925	0.26333	0.23199	0.20462	0.07789
15	0.86135	0.79985	0.74301	0.69047	0.64186	0.59689	0.55526	0.51672	0.48102	0.44793	0.41727	0.36245	0.31524	0.27454	0.23939	0.20900	0.18270	0.06491
16	0.85282	0.78803	0.72845	0.67362	0.62317	0.57671	0.53391	0.49447	0.45811	0.42458	0.39365	0.33873	0.29189	0.25187	0.21763	0.18829	0.16312	0.05409
17	0.84438	0.77639	0.71416	0.65720	0.60502	0.55720	0.51337	0.47318	0.43630	0.40245	0.37136	0.31657	0.27027	0.23107	0.19784	0.16963	0.14564	0.04507
18	0.83602	0.76491	0.70016	0.64117	0.58739	0.53836	0.49363	0.45280	0.41552	0.38147	0.35034	0.29586	0.25025	0.21199	0.17986	0.15282	0.13004	0.03756
19	0.82774	0.75361	0.68643	0.62553	0.57029	0.52016	0.47464	0.43330	0.39573	0.36158	0.33051	0.27651	0.23171	0.19449	0.16351	0.13768	0.11611	0.03130
20	0.81954	0.74247	0.67297	0.61027	0.55368	0.50257	0.45639	0.41464	0.37689	0.34273	0.31180	0.25842	0.21455	0.17843	0.14864	0.12403	0.10367	0.02608
21	0.81143	0.73150	0.65978	0.59539	0.53755	0.48557	0.43883	0.39679	0.35894	0.32486	0.29416	0.24151	0.19866	0.16370	0.13513	0.11174	0.09256	0.02174
24	0.78757	0.69954	0.62172	0.55288	0.49193	0.43796	0.39012	0.34770	0.31007	0.27666	0.24698	0.19715	0.15770	0.12640	0.10153	0.08170	0.06588	0.01258
25	0.77977	0.68921	0.60953	0.53939	0.47761	0.42315	0.37512	0.33273	0.29530	0.26223	0.23300	0.18425	0.14602	0.11597	0.09230	0.07361	0.05882	0.01048
28	0.75684	0.65910	0.57437	0.50088	0.43708	0.38165	0.33348	0.29157	0.25509	0.22332	0.19563	0.15040	0.11591	0.08955	0.06934	0.05382	0.04187	0.00607
29	0.74934	0.64936	0.56311	0.48866	0.42435	0.36875	0.32065	0.27902	0.24295	0.21168	0.18456	0.14056	0.10733	0.08215	0.06304	0.04849	0.03738	0.00506
30	0.74192	0.63976	0.55207	0.47674	0.41199	0.35628	0.30832	0.26700	0.23138	0.20064	0.17411	0.13137	0.09938	0.07537	0.05731	0.04368	0.03338	0.00421
31	0.73458	0.63031	0.54125	0.46511	0.39999	0.34423	0.29646	0.25550	0.22036	0.19018	0.16425	0.12277	0.09202	0.06915	0.05210	0.03935	0.02980	0.00351
40	0.67165	0.55126	0.45289	0.37243	0.30656	0.25257	0.20829	0.17193	0.14205	0.11746	0.09722	0.06678	0.04603	0.03184	0.02209	0.01538	0.01075	0.00068

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

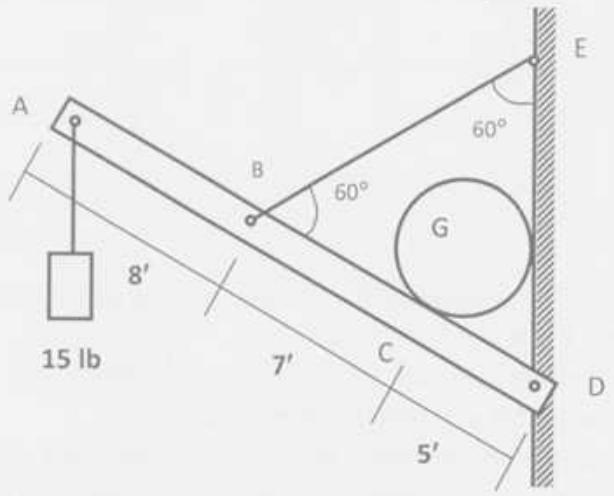
Course Title: Engineering Mechanics I — Course Code: CE 101(SECA)
Time: 3 hours — Full Marks: 100

Section A
There are 6 questions. Answer any 5 questions. **(5x10=50 marks)**

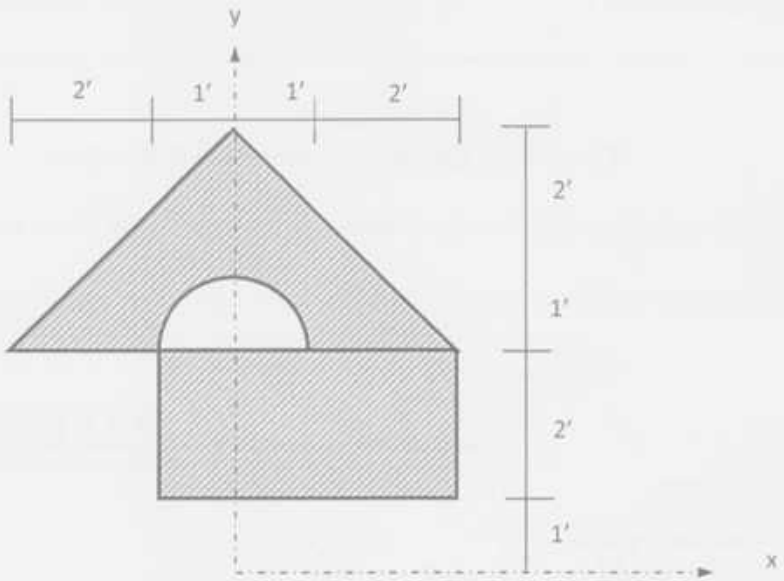
1. In the figure shown below, calculate the reactions at supports A and F and pin reactions at B.



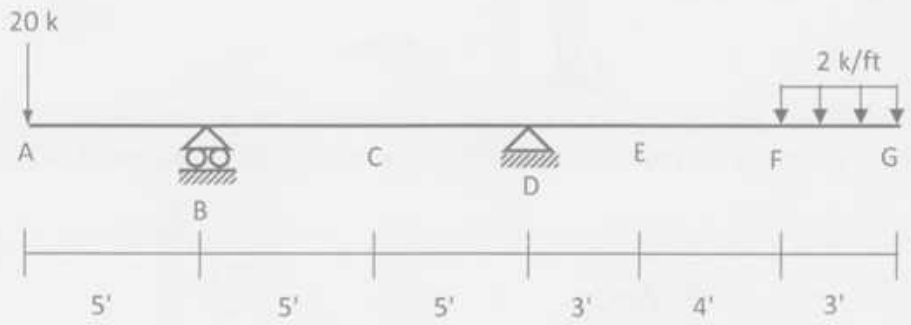
2. In the structure shown below, the weight of sphere G is 10 lb and member ABCD is 20 lb. Calculate the force in EB and the reactions at D. Also draw the free-body diagram of ABCD.



3. Locate the centroid of the shaded area and show its location in the figure below.



4. In the figure shown below, calculate the reactions at supports B and D and the shear force and bending moment at F.



5. Derive the expression for the centroid of a sector of a circle that makes an angle 2φ.
6. By applying theorem Pappus and Guldinus,
   (i) Determine the area generated by revolving a line about y axis. The length of the line is 10 ft and 30° slope with x axis through an angle 270°.
   (ii) Determine the volume generated by revolving a triangular area about its base (along x axis). One side (height) of the triangle is 10 inch (along y axis) and the base of the triangle is 6 inch.

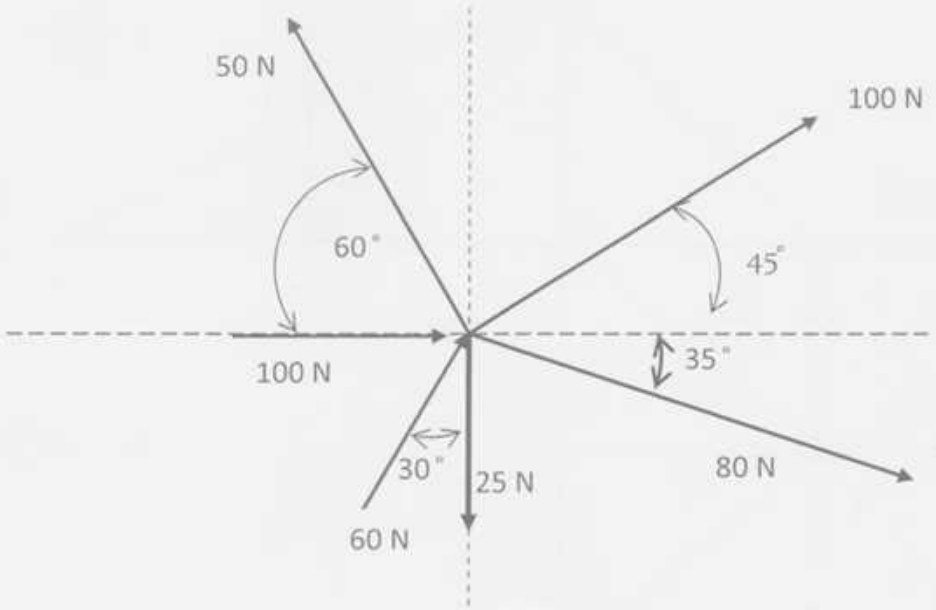
Section B

There are 6 questions. Answer any 5 questions. **(5x10 = 50 marks)**

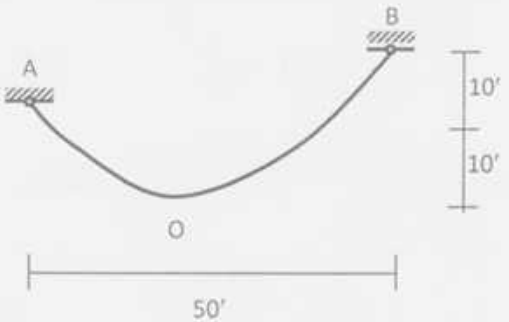
7. Find the moments of inertia (I_x and I_y) of the area bounded by the parabola $x^2 = 9y$, the line x=9 inch and the x-axis.

8. Calculate the product of inertia (P_{xy}) for the area bounded by the parabola $y^2 = 4x$, x = 4 inch and the x axis.

9. Calculate the magnitude and direction of the resultant of the given force system, consisting of 6 forces.

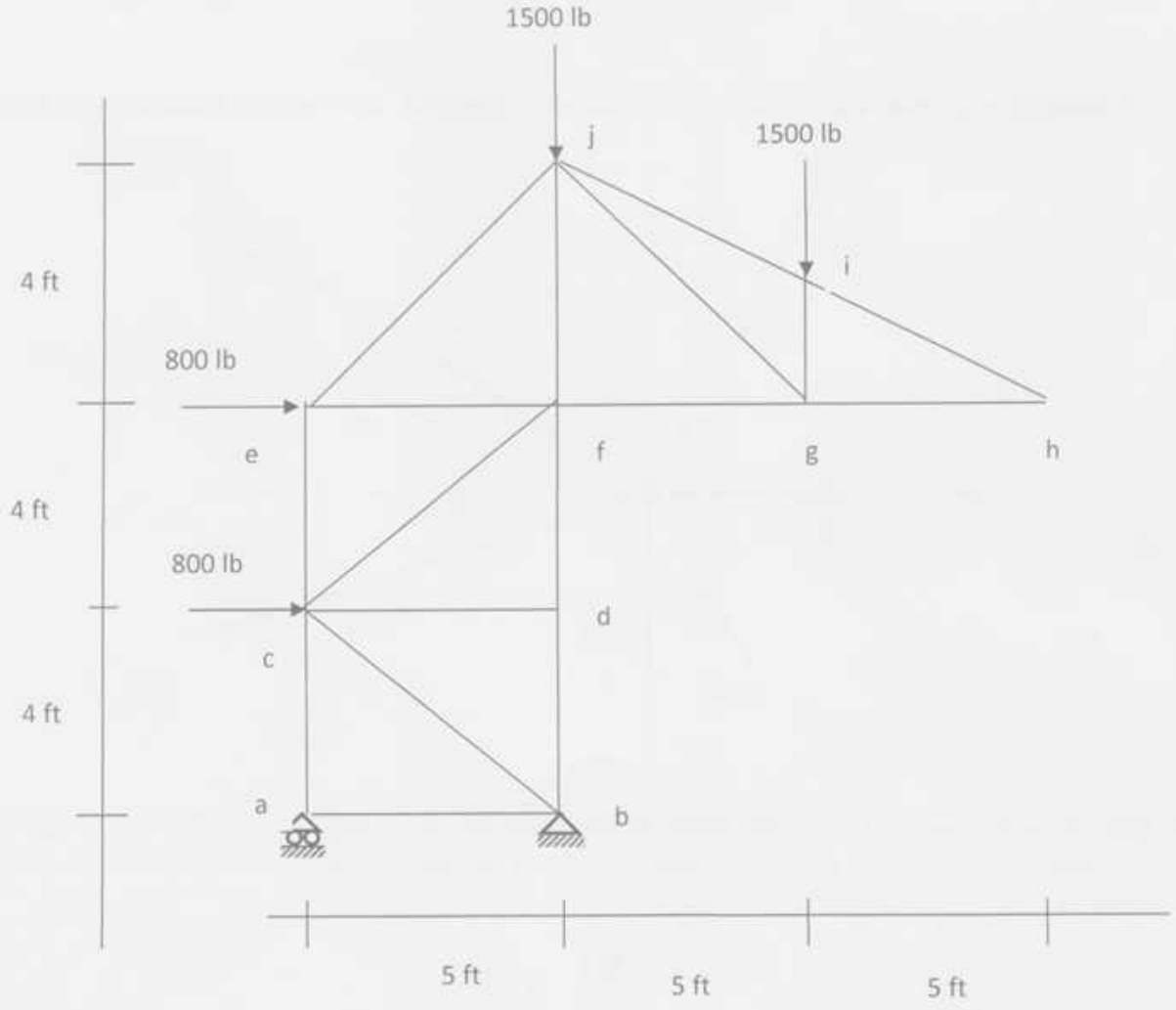


10. The horizontal tension (Q) in the cable AOB shown below is 100 lb. Calculate the weight per horizontal length (w) and maximum tension (F_{max}) in the cable. Assume the shape of the cable a parabola.



11. For a catenary shaped cable, derive the expression $s = k \sinh(x/k)$.

12. Find the force in members cd, cf, ej, gj and ac, in the given truss.



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B. Sc. Engineering (Civil)

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

Answer **any 10 (TEN)** of the following 14 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.

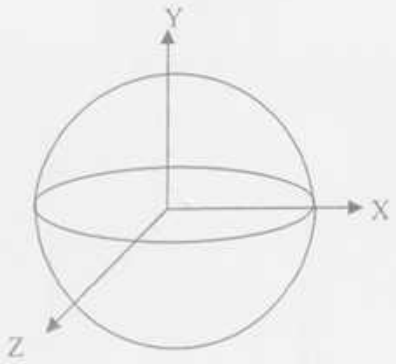


Figure 1

2. Determine the mass moment of inertia of the composite body shown in figure 2 about Y axis. It is given that unit weight of the material is 150 lb/ft^3.

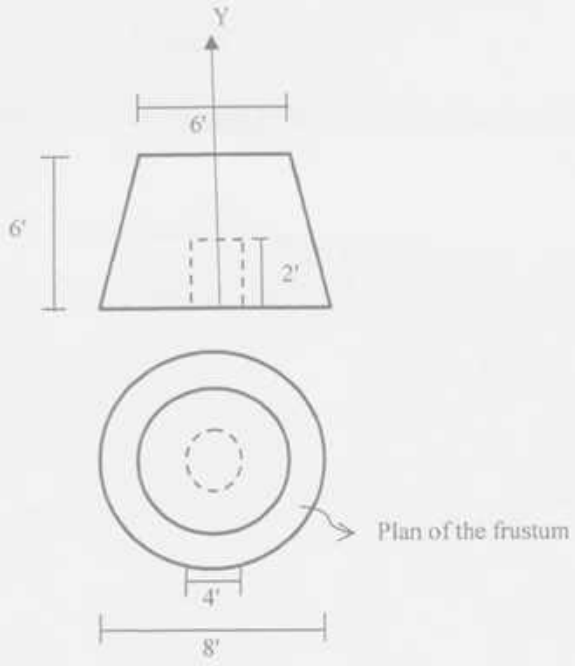


Figure 2

3. A block A weighing 300 lb is acted upon by a force Q whose direction is at 75° with the vertical as shown in Figure 3. A weightless cable connects A to another block B, which weighs 500 lb. If $f_A = f_B = 0.33$, determine (a) the force Q which will cause impending motion towards the left, (b) the tension in the cable.

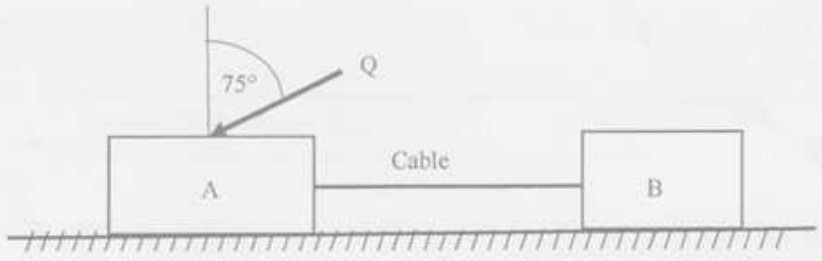


Figure 3

4. Determine the minimum amount of force that can be applied to the block in Figure 4 to maintain its impending motion. Given that $f_s = 0.2$.

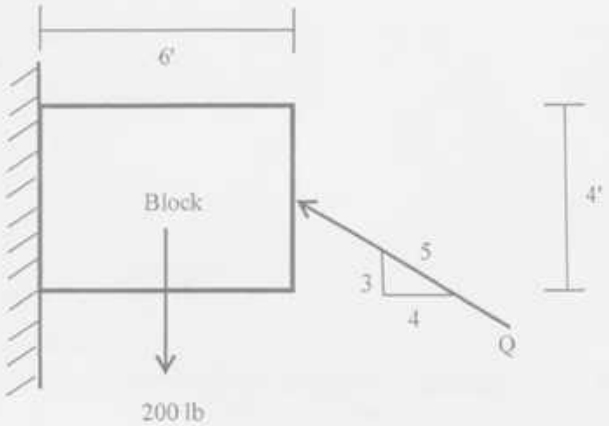


Figure 4

5. Determine the minimum load W that can be supported by the system shown in Figure 5.

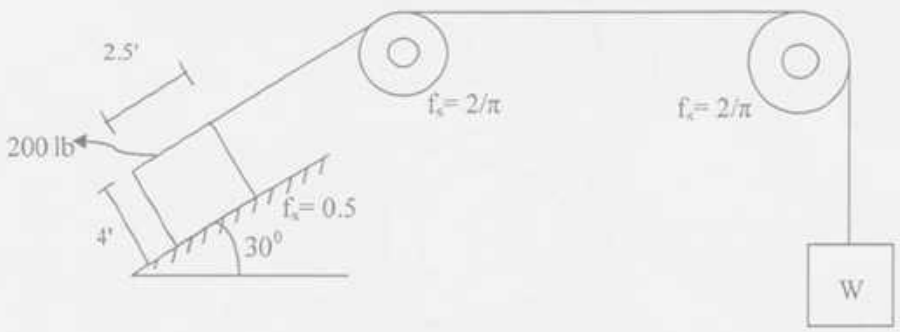


Figure 5

6. Th[illegible]lb brick slides down a smooth roof, such that when it is at A it has a velocity of 5 ft/s as shown in Figure 6. Determine the speed of the brick just before it leaves the surface at B, the distance *d* from the wall to where it strikes the ground, and the speed at which it hits the ground.

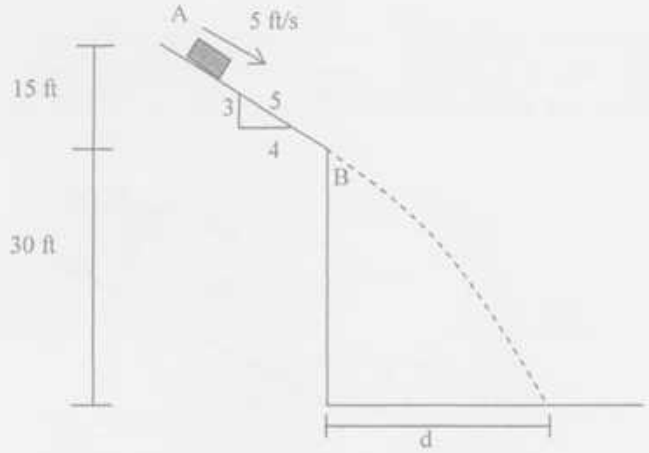


Figure 6

7. If the 10-lb block, shown in Figure 7, 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.

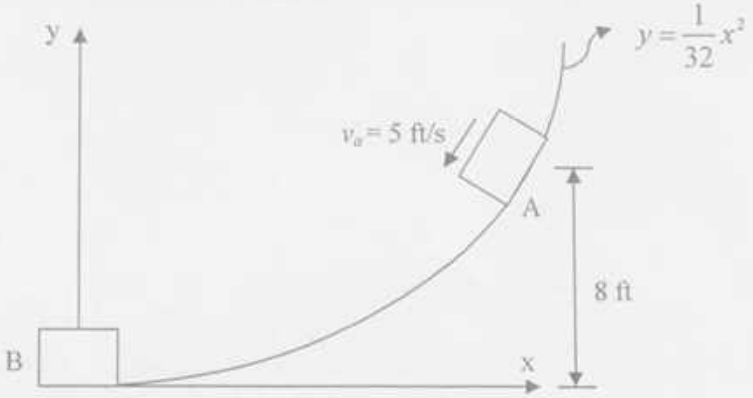


Figure 7

8. Based on observations, the speed of a jogger can be approximated by the relation $v = 7.5(1-0.04x)^{0.3}$, where v and x are expressed in mi/h and miles respectively. Knowing that $x = 0$ at $t = 0$, determine (a) the distance the jogger has run when t = 1h, (b) the jogger's acceleration in ft/s^2 at $t = 0$, (c) the time required for jogger to run 6 miles.

9. A 2.1 m tall volleyball player serves the ball with an initial velocity v_0 of magnitude 13.40 m/s at an angle 20° with the horizontal as shown in Figure 8. Determine
(a) if the ball will clear the top of 2.43 m net,
(b) how far from the net the ball will land at B?

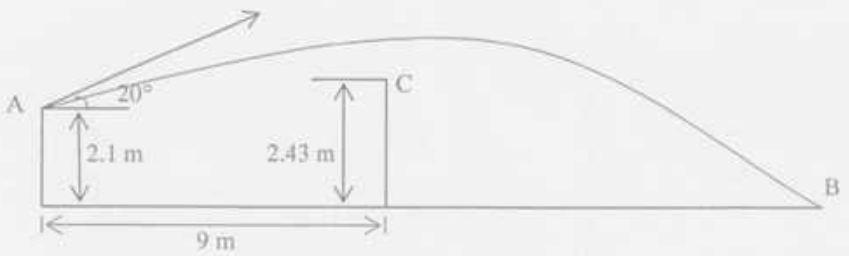


Figure 8

10. The 50 lb crate shown in Figure 9 is acted upon by a force having variable magnitude $P = (20t)$ lb, where t is in seconds. Determine the crate's velocity 2 s after P has been applied. The initial velocity is $v_1 = 3$ ft/s down the plane, and the coefficient of kinetic friction between the crate and the plane is 0.3.

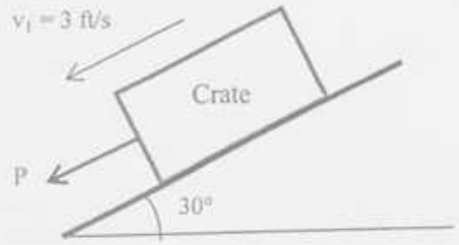


Figure 9

11. Two smooth disks A and B, having a mass of 1 kg and 2 kg, respectively, collide with each other with the velocities 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 both disks just after the collision.

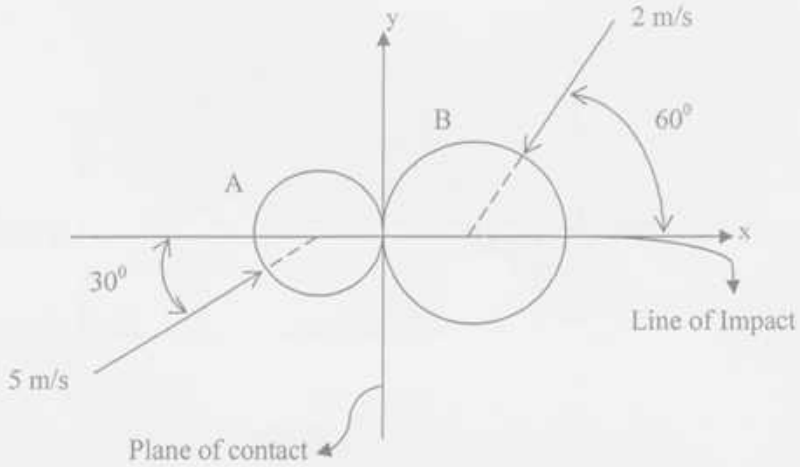


Figure 10

12. The 200 g projectile, shown in Figure 11, is fired with a velocity of 900 m/s towards the center of 15 kg wooden block, which rests on a rough surface. 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 will the block 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.

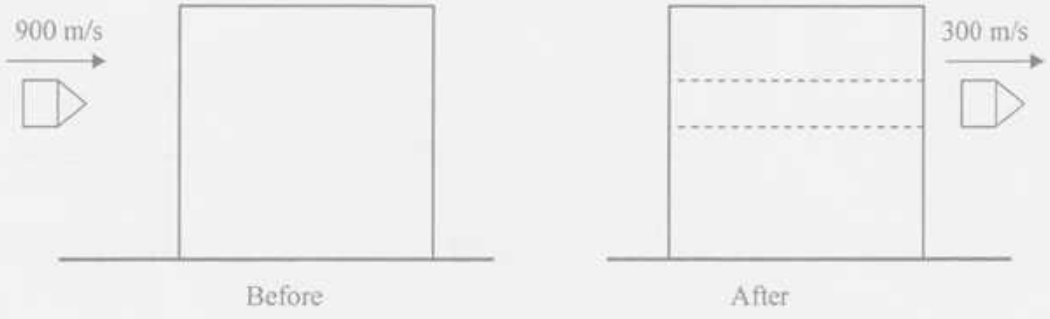


Figure 11

13. Determine the force in each cable used to support the 40-lb crate shown in Figure 12.

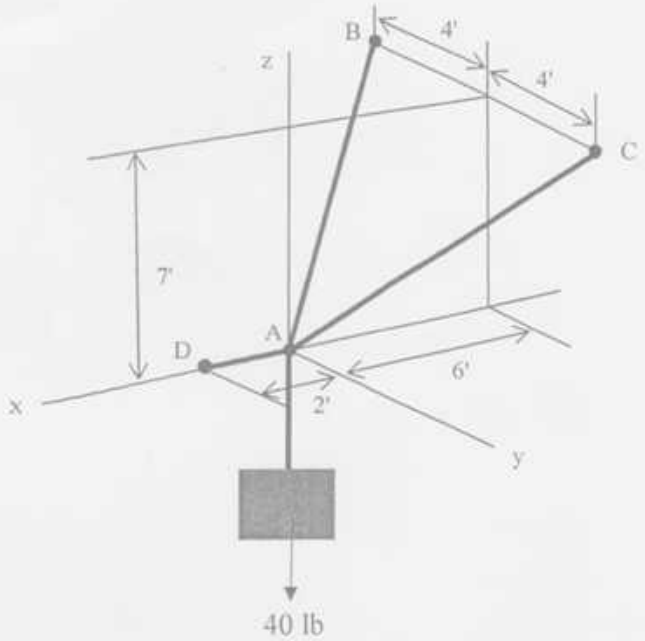


Figure 12

14. If each cable can withstand a maximum tension of 1000 N, determine the largest allowable weight of the cylinder shown in Figure 13.

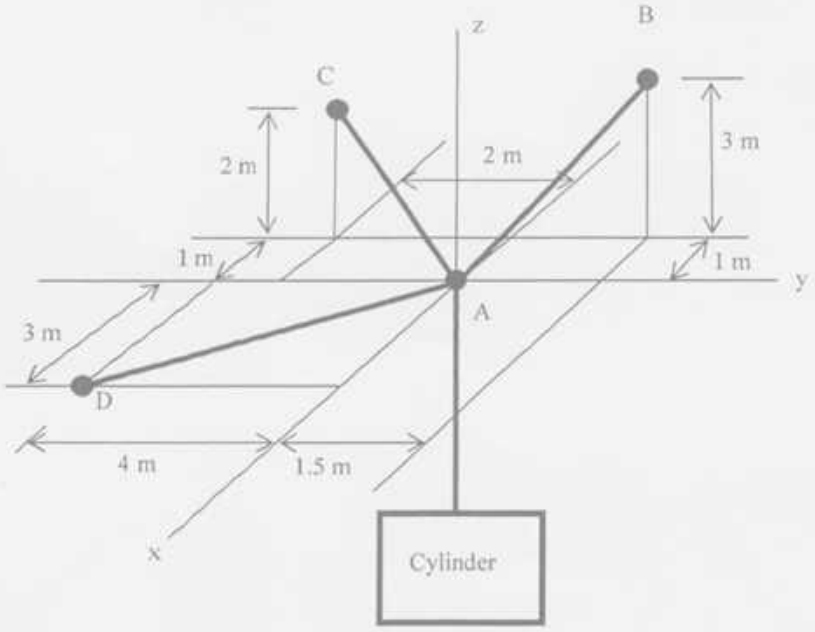


Figure 13

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B. Sc. Engineering (Civil)

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

SECTION A

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

1. (a) In a terrestrial photogrammetric survey, photo-theodolite was set up at A and B of a baseline which measured 120 meters. The print from A shows a point P 4.56 c.m. to the left of the vertical wire & 2.50 c.m. above the horizontal wire , that from B shows that the same point 5.80 c.m.to the vertical wire . The focal length of the camera is 12.5 c.m. The collimation level of A is 105 m. Calculate the distance and R.L. of P. **(See Figure 1)** $(6\frac{2}{3})$

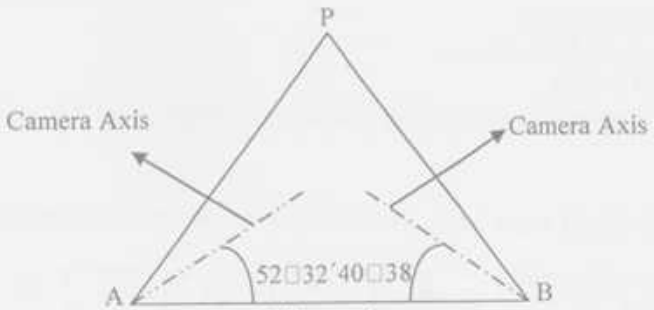


Figure 1

(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)	18	18	18	18

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

2. (a) Determine the shortest distance between two places A and B , given that the latitude of A and B are 15° N and 12°6′ and their longitudes are respectively 120°W and 70°E. Find also the direction of B on the great circle route. (11)

(b) Two points A and B having elevations of 500 m and 300 m respectively above datum appear on the vertical photograph having focal length of 10 cm and flying altitude of 2500 m above datum .Their corrected photographic co-ordinates are following : $(5\frac{1}{3})$

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

Determine the length of the ground line AB.

3. (a) Define the following terms with neat sketches (6)
Zenith and Nadir, Celestial Equator ,

(b) A tacheometer fitted with an anallatic lens was set up at A. The following observations were made on a vertically held staff: (10⅔)

Instrument Station	Staff Point	Whole Circle Bearing	Vertical Angle, Θ	Reading(ft)		
A	X	45°30'	0	3.5	4.5	5.5
A	P	32°30'	-2 °30'	2.25	3.25	4.25
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. Determine horizontal distance between P & Q.

4. (a) The following offsets were taken from a chain line to an irregular boundary line: (8)

Chainage(m)	0	15	30	45	60	70	80	100
Offstes(m)	6.5	9.5	13	13.5	10.9	8.5	8.0	7.5

Calculate the area between the survey line, irregular boundary line and end offsets by Trapezoidal rule and Simpson's rule.

(b) Distinguish between Horizon Co-ordinate System and Independent Equatorial Co-ordinate System with neat sketches. (2⅔)

(c) Determine Local apparent time (L.A.T.) when Local Mean Time (L.M.T.) is 10h 30m 30s at Longitude 30°18' W. Given that, Equation of time at G.M.N. is 6m 4.35s increasing at a rate of 0.30 s/h. (6)

SECTION B

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

1. (a) How can you drop a perpendicular to a Chain Line from a point outside it? (3⅓)

(b) Define field book. Write down the name of different instruments used for chaining. (04)

(c) A survey line BAC crosses a river , A and C being on the near and distant banks respectively. Standing at D, a point 50 meters measured perpendicularly to AB from A, the bearings of C and B are 320° and 230° respectively, AB being 25 meters. Find the width of the river. (09)

2. (a) Write short notes on i) Magnetic Declination ii) Local Attraction. (03)

(b) In a traverse ABCDE the following bearings were observed by a prismatic compass (13⅔)

Line	Fore Bearing	Back Bearing
AB	75°5'	254°20'
BC	115°20'	296°35'
CD	165°35'	345°35'
DE	224°50'	44°5'
EA	304°50'	125°5'

Is there any local attraction at any station, if so then correct the bearings. If the declination was 5° W. What were the true bearings?

3. (a) Draw the figure of a Circular curve and show its various components. (03)

(b) Two tangents intersect at chainage 75+75, the deflection angle being 60° 30'. Calculate the necessary data for setting out a curve of 40 chain radius to connect the two tangents, if it is intended to set out the curve by offset from chords. Consider peg interval equals to 100 links, length of the chain being equal to 20 m (100 links) (13⅔)

4. (a) Define Contour. Write down the consideration for selecting contour interval. (03)

(b) In leveling across an irrigation canal the following observations were made (13⅔)

Instrument Station	Staff Readings (m)	
	C	D
C	2.00	3.00
D	1.00	1.70

Distance between C and D=1000m. If the reduced level at C is 120, calculate the R.L. of D. Also calculate the curvature error, refraction error and collimation error.

Given formula:

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

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

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2014
Program: B. Sc. Engineering (Civil)

Course Code: CE 107 **Full Marks:150**
Course Title: Introduction to Civil & Environmental Engineering **Time: 2 hours**

There are four (4) questions in each section. Answer any three (3) questions from each section (25×6=150)

Section A

Answer any three (3) questions from the following. (25×3 = 75)

1. (a) Differentiate between Climate and Weather. What are the indicators of Climate Change? Name the five components of climate system. [4+4+5=13]
   (b) What is green house gas effect? Provide three examples of green house gases. [4]
   (c) Explain "global warming" phenomenon and state at least two factors that affect it. What are some possible effects of a warmer world? [6+2]

2. (a) Define Air Pollution. What are the indoor and outdoor sources of Air Pollution? [8]
   (b) Define point and non point sources of water pollution with examples. Mention some steps to control water pollution. [5+3]
   (c) Explain (i) Acid Rain (ii) Noise Pollution [6]
   (d)What do you mean by Time of Exposure related to air pollution? [3]

3. (a) Explain (i) Bio-diversity (ii) Ecosystem (iii) Habitat (iv) Bio-mass [10]
   (b)What are the major elements or macronutrients that the living organisms need in order to survive? Draw the flow of matter/nutrients and energy through ecosystem. [2+8]
   (c) Define Renewable and Non-renewable Resources with examples. [5]

4. (a) Define "Wetland". Why Wetlands are valuable? What are the impacts of Wetland degradation? [2+4+7=13]
   (b) Mention which part of Bangladesh is vulnerable to Flash Flooding and landslides? [3]
   (c)What are the different types of natural disasters in Bangladesh? Write down some of the major impacts that are caused by these disasters. [5+4]

Section B

Answer any three (3) questions from the following. (25×3 = 75)

5. (a) Provide at least three differences between developed (rich) nations and developing (poor) nations with respect to demographic (population dynamics) parameters. State the underlying reason of negative environmental impact in each of these. [7]
(b) Define carrying capacity. State the factors that need to be considered in order to evaluate how many people the earth can support. [3+5]
(c) What is ecological footprint? Provide at least two examples on how you can reduce your footprint. [5]
(d) Explain how you can evaluate population impact on environment. State necessary equation (if any). [5]

6. (a) Differentiate between (i) Roller support and Hinged support (ii) Tension and Compression (iii) Rotation and Torsion (iv) Sub-structure and super-structure [8]
(b)A company is planning to build a three story building on a constructing site that has a land area of 150 ft × 100 ft. If the first two stories are 100 ft × 100 ft and the remaining story is 120 ft× 130 ft, calculate the Floor Area Ratio (FAR). [10]
(c) Give examples of (i) Building Services and (ii) Building Finishes [4]
(d) What are the ingredients of Concrete? [3]

7. (a) Name different modes of structural failure of (i) Steel (ii) Concrete (iii) Timber [9]
(b) Write down the names of five major disciplines of Civil Engineering. [5]
(c) Modulus of Elasticity of a rubber is 15 MPa and the rubber is pulled to elongate 10 mm. The original length of the rubber is 100 mm. Using Hook's law find out the stress at which the rubber was pulled. [5]
(d) Mention some very important roles of civil Engineers in the development of infrastructure. [6]

8. (a) Why is soil investigation necessary for a foundation? Write down the names of at least three tests relating to soil investigation. [7+3]
(b) What are the different modes of transportation in Bangladesh? State the names of at least three authorities that are responsible for maintaining these networks. [6]
(c) Write down the total coverage of different modes of transportation in Bangladesh in terms of percentage of total area/total number of stations/total length i.e. whichever is applicable for each mode of transport. [4]
(d) What is Geotechnical Engineering? Provide some examples of geotechnical engineering project. [5]

2-1

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc Engineering (Civil)

(A)

Course Title: Engineering Materials | Course Code: CE 201
Time: 3:00 hours | Full Marks: 150

Answer any 6 (Six) of the following 7 Questions

Question 1:

a. Classify aggregates according to geological origin, size, shapes, unit weight and texture. (5)
b. Write short note on ASR. (5)
c. Explain how aggregates affect the workability of concrete. (5)
d. Following sample of aggregates to be blended with the percentage shown. Calculate the F.M of blended aggregates. (10)

Sieve Size	% passing	
	Aggregate 1	Aggregate 2
50 mm (2 in)	100	100
37.5 mm (1.5 in)	100	100
25.0 mm (1 in)	100	100
19.0 mm (3/4 in)	100	100
12.5 mm (1/2 in)	100	99
9.5 mm (3/8 in)	100	89
4.75 mm (No.4)	99	24
2.36 mm (No. 8)	85	3
1.18 mm (No. 16)	65	0
0.6 mm (No. 30)	38	-
0.3 mm (No. 50)	15	-
0.15 mm (No. 100)	4	-
0.075 mm (No. 200)	1	-
% by mass	65%	35%

Question 2:

a. What is calcination of lime? What are Fat limes, Lean Limes and Hydraulic Lime? (4)
b. Write short note on Fly ash mentioning its source, properties and application. (5)
c. Show wet process of cement production in a neat flow-diagram (4)
d. What is Rapid Hardening Cement? Write down its manufacturing technique and its application. (4)
e. Describe different stages of cement hydration process. (8)

Question 3:

a. Deseribe the functions of chief ingredients of Brick. (8)
b. Explain the Efflorescence test and Field tests of Brick. (4)
c. What is Aerated Concrete Blocks? How are they made? (4)
d. Describe different types of 'Special Mortars'. (7)
e. What are the typical proportions of cement to sand in mortar for Masonry wall, Foundation, Plaster work? (2)

Question 4:

a. Explain bleeding of concrete and its cause. How can it be prevented? (7)
b. What is laitance of concrete? (2)
c. "Permeability of concrete is a key factor related to durability of concrete" – why? (5)
d. What are the physical and chemical mechanisms of concrete deterioration? (7)
e. Classify the types of cracking in concrete. (4)

Question 5:

A concrete mix is required for a 1.0 m thick mat foundation. Design compressive strength of concrete is 20 MPa at 28 days. Slump value of concrete must be in between 100-150 mm. Determine the first lab trial mix as per ACI volume method with following information and necessary tables (Tables 1-6). (25)

i. Cement is ordinary Portland cement.
ii. A water reducing admixture (specific gravity 1.25) will be used so that you can reduce 15% water content. Recommended dose 800 ml per 100 kg cement

For first trial mix, three cylinders with ACI standard dimensions are cast. Assume 30% loss in cylinder casting. Measured density and slump value of first lab trial mix was found 2430 kg/m^3 and 85 mm respectively when 0.4 kg additional water was mixed in excess of the required water.

Question 6:

a. Why grading of aggregate is important? (5)
b. Describe Chloride and Carbonation induced corrosion. (6)
c. What is drying shrinkage of concrete? What are the factors influence drying shrinkage? (5)
d. Define Ferrocement and write down its specification. (5)
e. What are cullet and discolorizers in glass manufacturing? Why are they used? (4)

Question 7:

a. Describe with figures: Elastic Material, Plastic Material, Elasto-Plastic Material and Elasto-Visco-Plastic Material (8)
b. What is vulcanization of rubber? Why is it necessary? (3)
c. Explain Bulking of sand. (3)
d. Draw a neat sketch of timber section and show different parts of it. (5)
e. Briefly describe the Constituents of an oil paint (6)

Necessary Tables for Question No. 5

Table 1: Properties of Fine Aggregate

Sl. No.	Property	Test Method	Value	Unit
1	Bulk Specific Gravity (OD basis)	ASTM C127	2.52	-
2	Apparent Specific Gravity (OD basis)	ASTM C127	2.60	-
3	Absorption Capacity	ASTM C127	1.50	%
4	Dry Rodded Unit Weight	ASTM C29	1570	kg/m^3
5	Moisture Content of FA in Laboratory		3.50	%
6	Fineness Modulus (FM)	ASTM C136	2.80	

Table 2: Properties of Coarse Aggregate

Sl. No.	Property	Test Method	Value	Unit
1	Bulk Specific Gravity (OD basis)	ASTM C127	2.62	-
2	Apparent Specific Gravity (OD basis)	ASTM C127	2.68	-
3	Absorption Capacity	ASTM C127	1.00	%
4	Dry Rodded Unit Weight	ASTM C29	1530	kg/m^3
5	Moisture Content of CA in Laboratory	-	0.5	%
6	Maximum Size	-	25	mm

Table 3: Properties of cement

Sl. No.	Property	Test Method	Value	Unit
1	Brand name		supercrete (composite)	-
2	Clinker		85	%
3	Fly Ash		15	%
4	Compacted Unit Weight		1400	kg/m^3
5	Loose Unit Weight		1100	kg/m^3
6	Specific Gravity of clinker		3.15	
7	Specific Gravity of fly ash		2.40	

Table 4: ACI recommended w/c ratio for normal strength concrete

Mean Target Strength		W/C ratio
psi	MPa	
6000	41	0.41
5000	34	0.48
4000	28	0.57
3000	21	0.68
2000	14	0.82

Table 5: ACI recommended dry rodded bulk volume of coarse aggregate per unit volume of concrete

Max size of agg	FM of fine aggregate			
mm	2.40	2.60	2.80	3.00
9.5	0.50	0.48	0.46	0.44
12.5	0.59	0.57	0.55	0.53
19	0.66	0.64	0.62	0.60
25	0.71	0.69	0.67	0.65
37.5	0.75	0.73	0.71	0.69
50	0.78	0.76	0.74	0.72
75	0.82	0.80	0.78	0.76
150	0.87	0.85	0.83	0.81

Table 6: ACI recommended mixing water content for 1 m^3 fresh concrete

Max size of aggregate (mm)	10	12.5	20	25	40	50	70	150
Slump Value (mm)	Amount of mixing water in kg per 1 m^3 concrete							
25 to 50	207	199	190	179	166	154	130	113
75 to 100	228	216	205	193	181	169	145	124
150 to 175	243	228	216	205	190	178	160	-
Entrapped air (%)	3	2.5	2	1.5	1	0.5	0.3	0.2

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
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) What is diastraphism? Draw neat sketch of a typical fold geometry showing its major features. 5
   (b) Write short notes on folds, faults and joints and rock cleavage. 6
   (c) Classify and discuss briefly (with neat sketches) various types of folds. 9

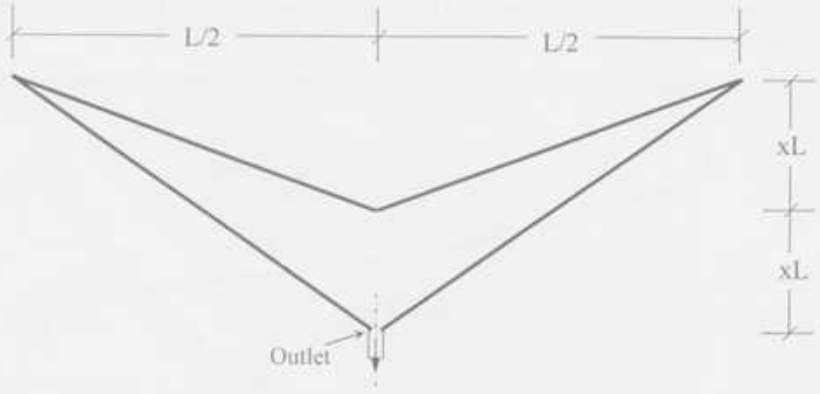
3. (a) Classify (mention names only) faults and draw sketch of any one type of fault. 4
   (b) Mention the aftermaths of liquefaction phenomenon. 4
   (c) Classify and discuss briefly (no sketch required) different types of waves generated due to earthquake. 8
   (d) Tabulate Modified Mercalli Intensity scales of earthquake (IX to XII). 4

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)**

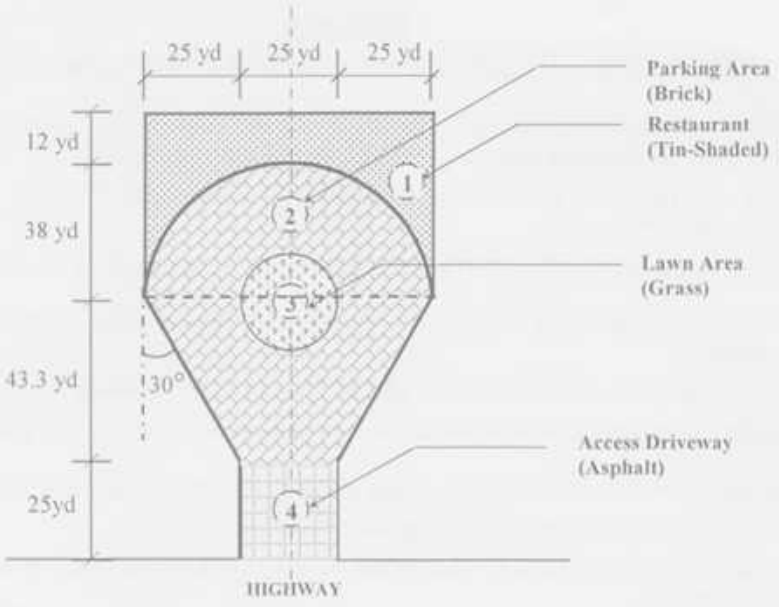
5. (a) Distinguish between infiltration and percolation. 3
   (b) Define flood hydrograph with sketch and time of concentration with sketch. 3
   (c) For the basin as shown below, x is a constant factor. For what value of x, the flow rate (Q) will be the maximum for the basin? Find the FF and CC of the basin for maximum runoff. 7



(d) Calculate the peak runoff (Q_p) for the following highway restaurant complex as shown below. Use the following data/information as necessary. 7

- Rainfall Intensity for the whole area = 0.1 mm/min
- The area is symmetric about y direction.

Area Type	Co-efficient of Runoff
Brick	0.68
Asphalt	0.72
Grass	0.24

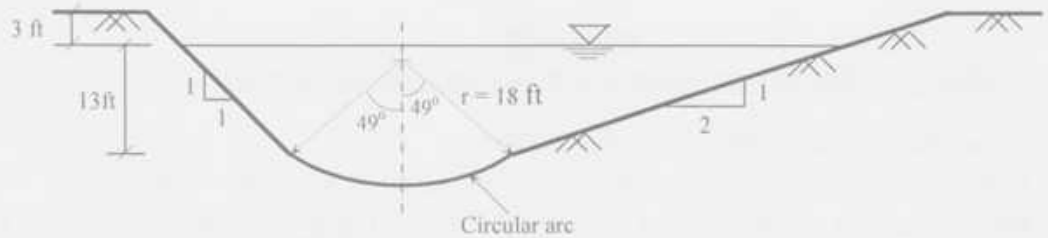


6. (a) What are the major causes of river erosion? Mention three hydraulic actions responsible for river erosion. 3

(b) Prove that $d \propto v^2$; where symbols carry their usual meanings. 7

(c) Two locations of a river has slopes of 1:5000 (V:H) and 1:12000 (V:H) at locations 1 and 2, respectively. Hydraulic radius at location 1 is 1.5 times the hydraulic radius at location 2. Compare erosional tendency of the same river at these two locations. 3

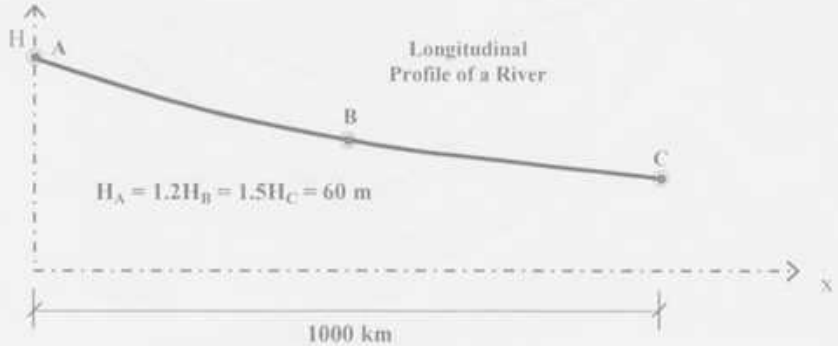
(d) Cross-sectional profile of a channel is shown below. The gradient of the channel bed is 3.33×10^{-4}. Calculate the tractive pressure along the channel. 7



X-Sectional Profile of Channel Course

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

(b) From the figure shown below, 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

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B. Sc. Engineering (Civil)

2-2

Course Title: Numerical Analysis and Computer Programming — Course Code: CE 205
Time: 3 hours — Full Marks: 100 (= 10 × 10)

There are **02 (TWO)** sections, **SECTION A** and **SECTION B**. Answer **BOTH** sections. Assume reasonable values for missing data only, if any.

SECTION A (Numerical Analysis)
[Answer any **07 (SEVEN)** of the following **09 (NINE)** questions.]

1. Using Crout's method find the solution of the following system of linear equations.

$$x + 2y + 5z = -11$$
$$y = 1$$
$$2x + 9y + 11z = -20$$

2. Find the root of the equation $\cos x - xe^x = 0$ using the bisection method between the interval [0,1] with $\varepsilon = 0.00001$.

3. Evaluate the integral of the following data using both Trapezoidal and Simpson's 1/3 rule .

$$I = \int_1^3 x^2 dx$$

Take at least up to eight intervals for better accuracy.

4. Using Romberg's quadrature method integrate

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

Take at least up to eight intervals for better accuracy.

5. A ball at 1200 K is allowed to cool down in air at an ambient temperature of 300 K. Assuming heat is lost only due to radiation, the differential equation for the temperature of the ball is given by

$$\frac{d\theta}{dt} = -2.2067 \times 10^{-12}(\theta^4 - 81 \times 10^8)$$
$$\theta(0) = 1200K$$

where θ is in K and t in seconds. Determine the temperature at t = 480 seconds using Runge-Kutta 4th order method. Assume a step size of h = 240 seconds.

6. Using Taylor's method determine y at $x = 1.1$ and 1.2 by solving

$$y' = x^2 + y^2$$
$$y(1) = 2.3$$

7. By Neville's method approximate f (27.5) from the following data.

x	f(x)
32	0.52992
22.2	0.37784
41.6	0.66393
10.1	0.17537
50.5	0.63608

8. Fit the curve $Y = ae^{bx}$ to the following data

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

9. Solve the following system using Gauss-Jordan elimination method.

$$x + y + z = 5$$
$$2x + 3y + 5z = 8$$
$$4x + 5z = 2$$

SECTION B (Computer Programming)

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

10. Write a program that can calculate the matrix summation of a 3×3 matrix.

11. Write a program that takes a Centigrade temperature as input and prints its Fahrenheit equivalent. Formula: °F= °C * (9/5) + 32.

12. Write a program that calculates the summation

$$S = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \ldots\ldots\ldots\ldots + \frac{(-1)^n x^{2n+1}}{(2n+1)!}$$

13. Write a program to find the largest value among three positive integers.

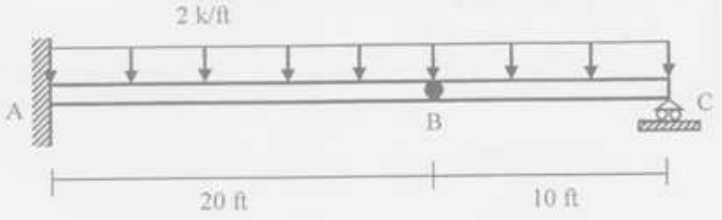
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc Engineering (Civil)

Course Title: Mechanics of Solids I
Time: 3:00 hours

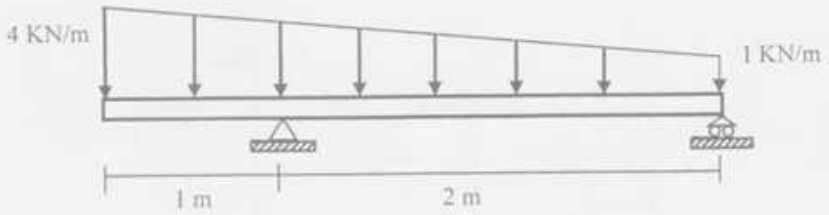
Course Code: CE 211
Full Marks: 10 x 10 = 100

Answer any 10 (Ten) of the following 14 Questions

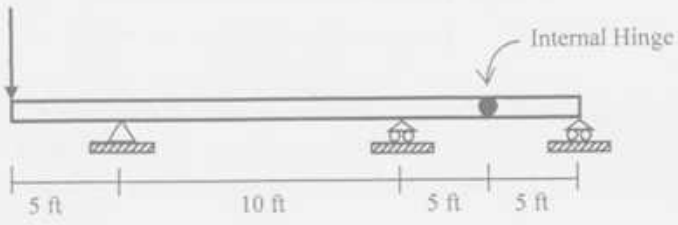
1. Draw SFD and BMD for the beam with loading shown below. *B* is an internal hinge.



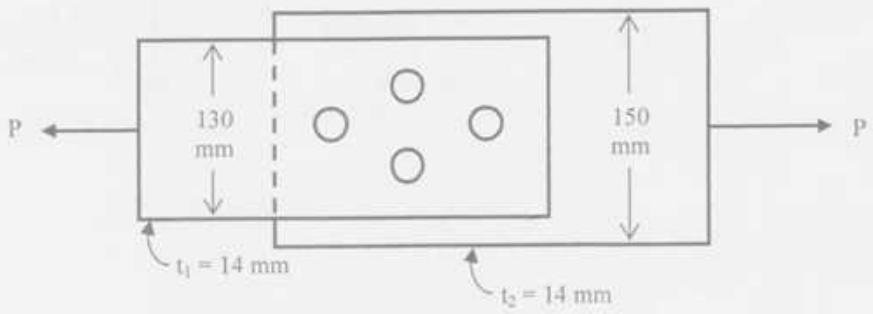
2. Derive the complete equations of Shear Force and Bending Moment of the beam shown below.



3. Using singularity function, draw SFD and BMD of the beam loaded as shown below.

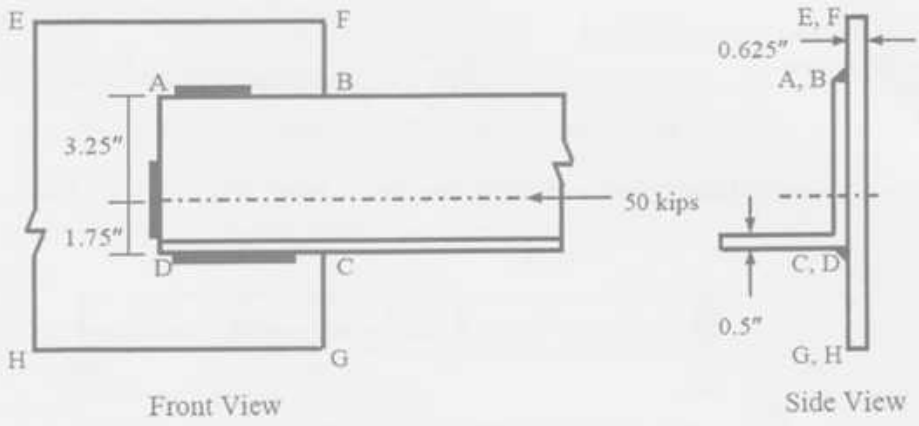


4. Two plates are joined by four rivets 25 mm in diameter as shown below. Calculate the allowable load P if the allowable shearing, tearing and bearing stresses are 80, 90 and 120 MPa respectively. (Assume holes for rivets are also 25 mm in diameter.)

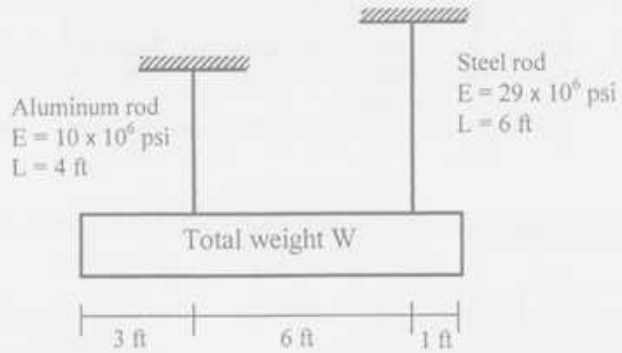


5. In the figure shown below, calculate the length of 3/8-inch weld joints required on sides *AB* and *CD* only, (ii) *AB*, *AD* and *CD* to connect the 0.5" thick channel section *ABCD* to the 0.625" thick plate EFGH. Axial force of 50 kips passes through centroid of *ABCD*

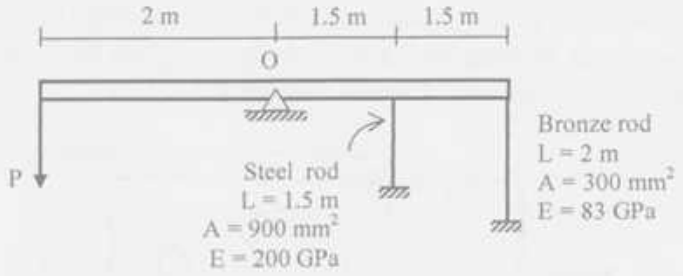
[Given: Allowable shear stress = 16 ksi].



6. A uniform concrte slab of total weight *W* is to be attached, as shown in the figure below, to two rods whose lower ends are on the same level. Determine the ratio of the areas of the rods so that the slab will remain level.

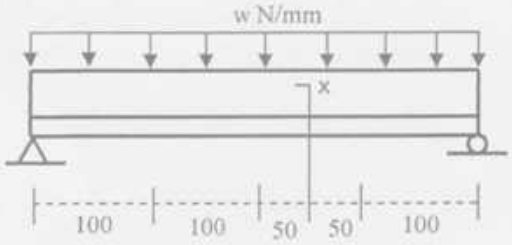


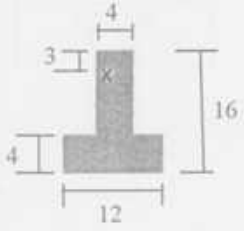
7. As shown below, a rigid bar with negligible mass is pinned at *O* and attached to two vertical rods. Assuming that the rods were initially stress-free, what maximum load *P* can be applied without exceeding stresses of 150 MPa in the steel rod and 70 MPa in the bronze rod?



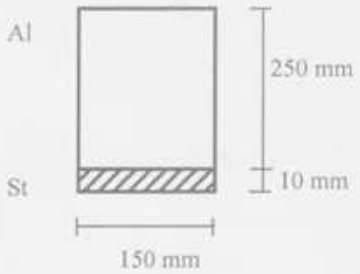
8. A cylindrical pressure vessel is fabricated from steel plate that has a thickness of 20 mm. The diameter of the pressure vessel is 450 mm and its length is 2.0 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 140 MPa and circumferential stress is limited to 60 MPa.

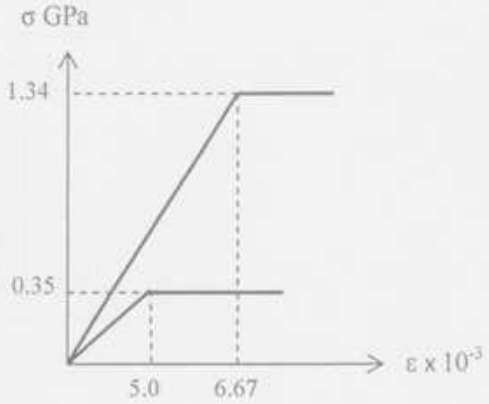
9. An inverted small steel T beam is supported at A and B as shown below. What is the value of uniformly distributed force w if a strain gauge attached at x point measures 0.0002 mm/mm when the load is applied. All dimensions are in mm. E = 200 GPa.



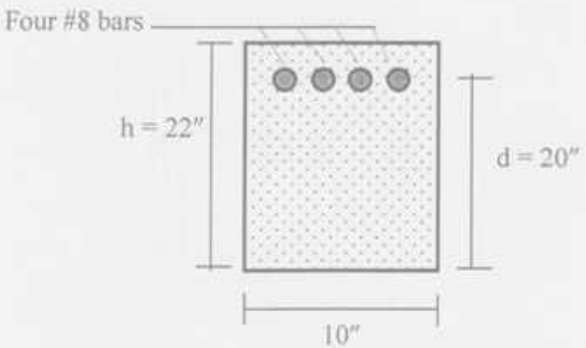


10. Consider a composite beam of the cross-sectional dimensions shown below. The upper 150x250 mm part is aluminum with the lower 10x150 mm strap is steel. If the beam is subjected to a bending moment of 30 kN-m around horizontal axis, what are the maximum stresses in the steel and aluminium?

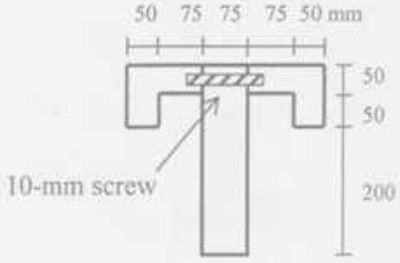




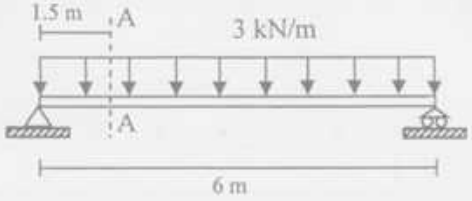
11. Determine the maximum stress in the concrete and the steel for a reinforced concrete beam with the section shown below if it is subjected to a positive bending moment of 50 kip-ft. The reinforcement consists of four #8 steel bars. Assume cracked section and n = 8.



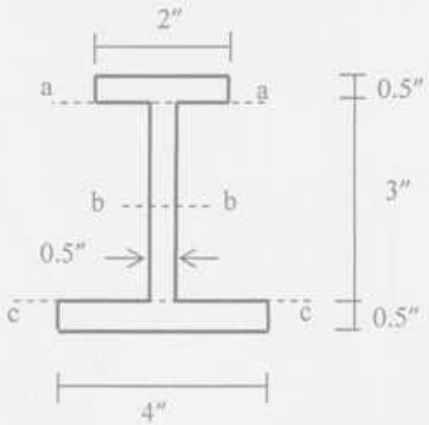
12. A simple beam on 6-m span carries a load of 3 kN/m including its own weight. Specify the spacing of 10-mm screw (as shown) necessary to fasten the parts together. Assume that allowable shear capacity for 10-mm screw is 2 kN.



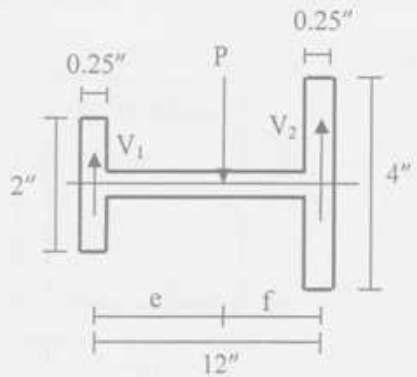
Section A-A



13. A beam having the cross section with dimension shown below, transmits a vertical shear V = 7 kip. Determine the shear stress at section a-a, b-b and c-c. Section b-b is at neutral axis.



14. Determine the approximate location of the shear center (value of *e* or *f*) for the cross section of the I beam shown in the figure.



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014 (Set 1)
Program: B. Sc. Engineering (Civil)

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

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

1. At section *d* of structural member *abcd* loaded as shown in Fig. 1,
   (i) Calculate the maximum normal stresses and determine the corresponding principal planes.
   (ii) Calculate the maximum shear stress and determine the corresponding plane.

2. For the member *abcd* loaded as shown in Fig. 1, calculate the required dimension (*B*) of the square footing *f*
   (i) To avoid overturning of the footing,
   (ii) To keep the normal stress under the footing within 1 k/ft^2.

3. The center of a Mohr's circle of stress is (100, 0).
   (i) Determine the radius of the circle and corresponding principal stresses if it satisfies the Von Mises yield criterion for a material with yield strength equal to 400 MPa.
   (ii) Use the principal stresses calculated in (i) to determine the yield strength of the material if it satisfies the Tresca yield criterion.

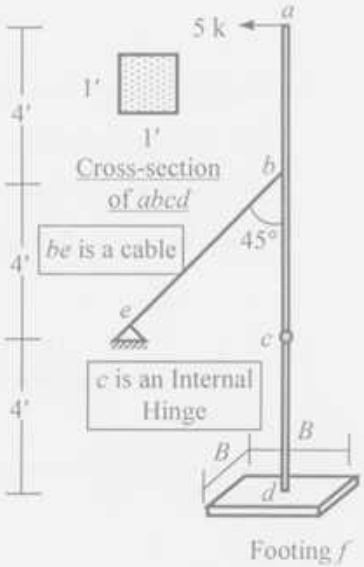


Fig. 1

4. For the rotating shaft *abcd* shown in Fig. 2
   (i) Calculate the distributed torque t_0 (k-ft/ft) required to make the torque at *d* equal to zero,
   (ii) Draw the corresponding torque diagram and calculate the torsional rotation at *b*
   [Given: Shear Modulus = 12×10^3 ksi].

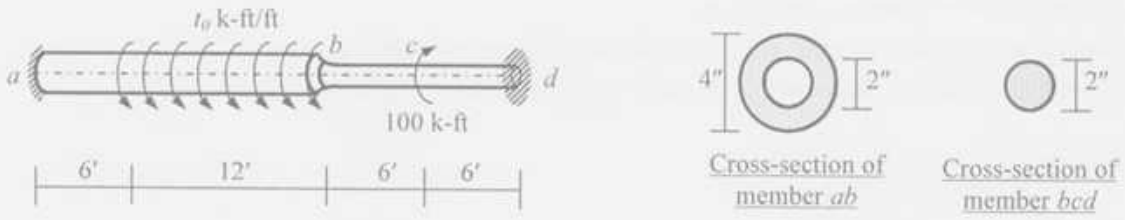


Fig. 2

5. Calculate the equivalent polar moments of inertia (J_{eq}) for the three cross-sections shown in Fig. 3 by centerline dimensions [Given: Wall thickness = 0.10" throughout].

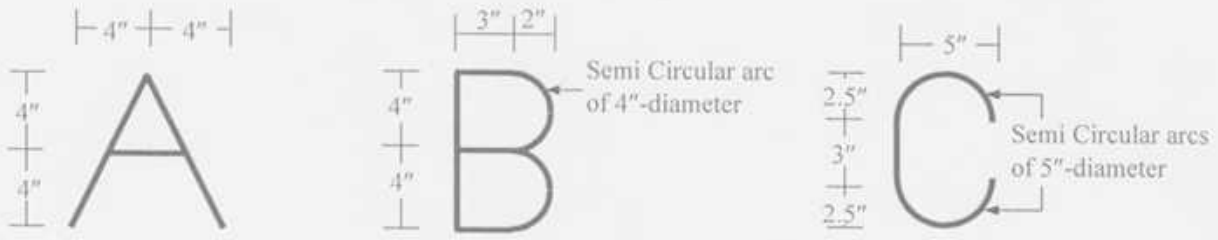


Fig. 3

6. Support *a* settles 0.03-m in the statically indeterminate beam *abc* shown in Fig. 4.
   (i) Calculate the distributed load w_0 (kN/m) required to make the deflection at *b* equal to zero,
   (ii) Draw the bending moment diagram of the beam
   [Given: $EI_{ab} = 40 \times 10^3$ kN-m^2, $EI_{bc} = 20 \times 10^3$ kN-m^2].

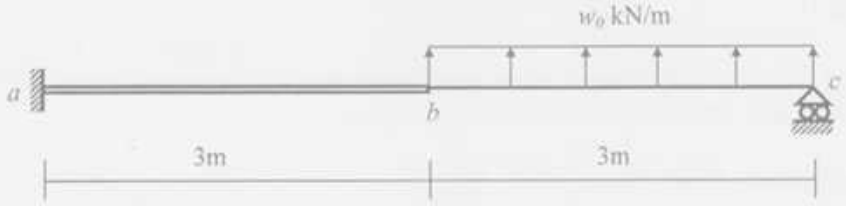


Fig. 4

7. Use *Singularity Functions* to calculate the
   (i) Vertical deflection at joint *b*
   (ii) Rotation just left and right of joint *b*
   of the beam *abcde* loaded as shown in Fig. 5 [Given: EI = constant = 40×10^3 k-ft^2].

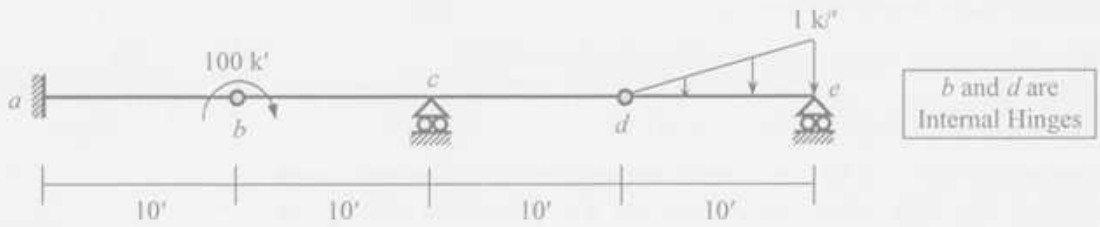


Fig. 5

8. Answer Question 7 using the *Moment-Area Theorems*.

9. Answer Question 7 using the *Conjugate Beam Method*.

10. For the beams (Beam 1 and Beam 2) shown in Fig. 6
   (i) Write down the equations for load *w(x)* using singularity functions.
   (ii) Write down the boundary conditions.
   (iii) Determine whether the beams are statically determinate or indeterminate.
   (iv) Draw the qualitative deflected shapes of the beams under the given loads.

Fig. 6

11. Fig. 7(a) shows an initially imperfect simply supported beam [with $v_i(x) = v_{i0} \sin(\pi x/L)$] subjected to concentric compressive force P, while Fig. 7(b) shows an initially straight beam subjected to the same eccentric compressive force P.

If $v_{i0} = e = 0.03$m, $E = 200 \times 10^3$ MPa, determine the force P required to make $v_{m(b)} = v_{m(a)}$.

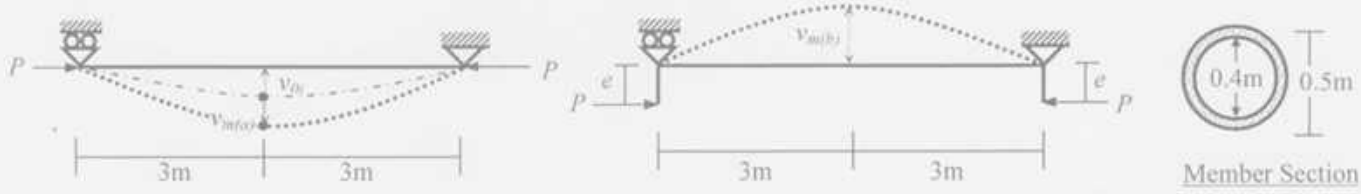


Fig. 7(a) Fig. 7(b)

12. Fig. 8 shows an elastic fully plastic simply supported straight beam (subjected to eccentric axial force P), along with the moment-curvature relationship of its cross-section. Calculate the

(i) Eccentricity e if the axial force capacity is $P = 500$ kN

(ii) Axial force capacity P' if the eccentricity e' is double the value calculated in (i); i.e., $e' = 2e$.

Fig. 8

13. Use the *AISC-ASD criteria* to calculate the allowable force F_0 on the frame shown in Fig. 9, considering compression of columns *ab* and *bc* [Given: $E = 4 \times 10^3$ ksi, $f_y = 4$ ksi].

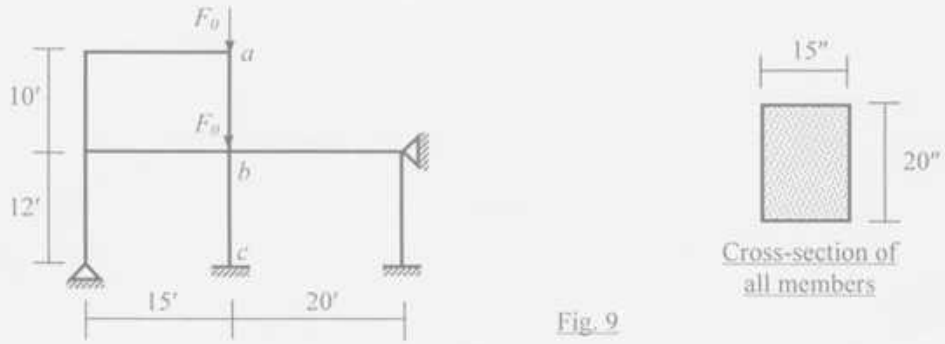


Fig. 9

14. For the frame *abc* shown in Fig. 10, calculate the

(i) Concentrated force F_0 needed to cause buckling of column *ab* and *bc*,

(ii) Maximum bending moment in the two members if F_0 is equal to half the force calculated in (i) [Given: Modulus of elasticity $E = 3 \times 10^3$ ksi].

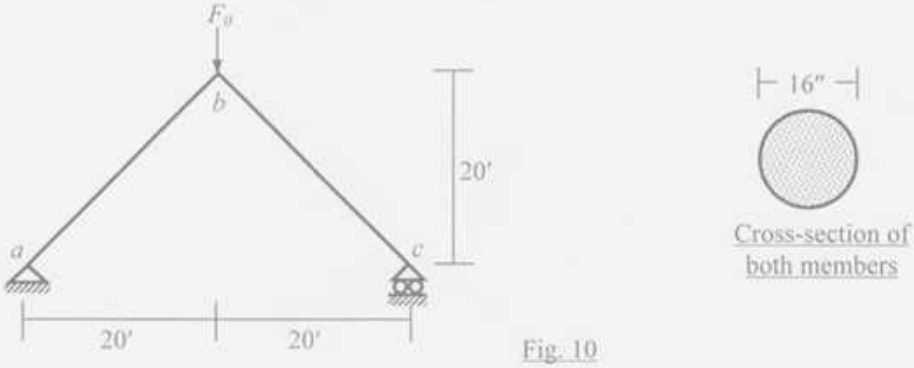


Fig. 10

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

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

The symbols have their usual meanings.
The figures at the right margin indicate full marks.

Section-A

(There are **4 (Four)** questions in this section. Answer any **3 (three)** questions.)

1. (a) Define Viscosity. Derive Newton's equation of viscosity. (8)

(b) A cubical block weighing 200 gm and having a 20 cm edge is allowed to slide down on an inclined plane surface making an angle of 30^0 with the horizontal on which there is a thin film having a viscosity of 2.2×10^{-3} N-s/m^2. What terminal velocity will be attained if the film thickness is estimated to be 0.35 mm? (9)

(c) Calculate the pressure difference between points A and B (as shown in Figure 1). Specific gravity of water is 9.81 kN/m^3. (8)

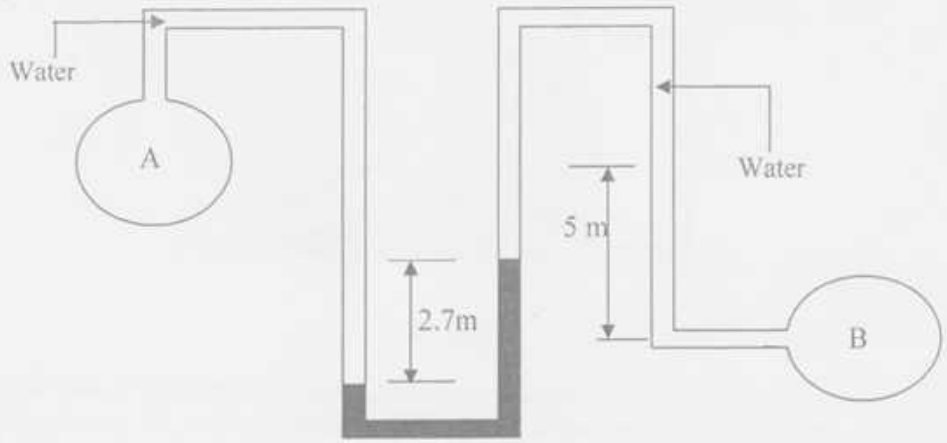


Figure-1

2. (a) Prove that pressure at any point in a fluid at rest is the same in all directions. (5)

(b) Determine vertical and horizontal components of force acting on radial gate ABC and their line of action. The shape of the gate is a quadrant of a circle of radius 4 m (Figure-2). The upper portion of the gate is at a depth of 3 m from the free surface. (12)

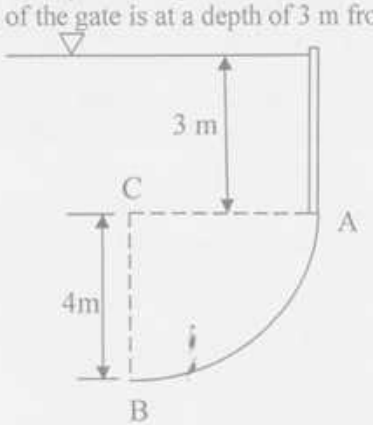


Figure- 2

(c) A jet of water flowing freely in atmosphere is deflected by a curved vane as shown in Figure 3. If the water jet has a diameter of 4 cm and a velocity of 30 m/s then determine the reaction on the vane. (8)

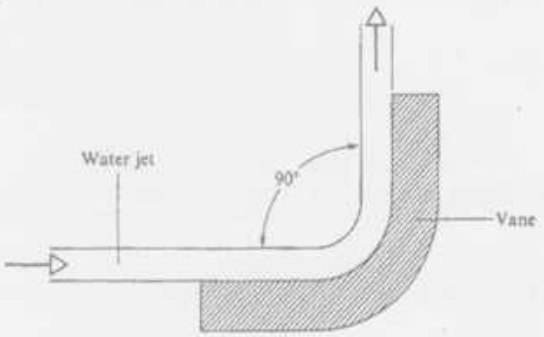


Figure- 3

3.(a) Flow occurs over a spillway of constant section as shown in Figure- 4. Determine the horizontal force on the spillway per foot of spillway width. Assume ideal flow. (10)

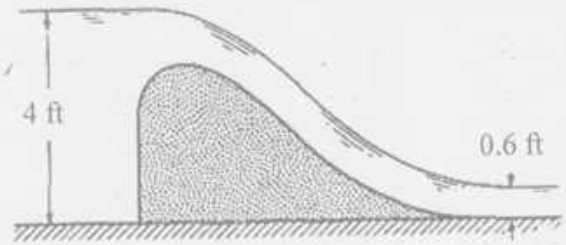


Figure- 4

(b) Consider the drag force F_D exerted on a sphere as it moves through a viscous liquid. Certainly, the size of the sphere must influence the drag force. Also, the velocity of the sphere must be important. The fluid properties involved are the density ρ and the viscosity μ. Derive an expression for the drag force on the sphere by Buckingham's π method. (15)

4.(a) Water (0^0 C) flows in a 75 mm horizontal pipeline with a mean velocity of 3 m/s. The pressure drop in 10 m of this pipe is 14 KPa. With what velocity must gasoline (20^0 C) flow in a geometrically similar 25 mm pipeline for the flows to be dynamically similar, and what pressure drop is to be expected in 3.33 m of the 25 mm pipe. The phenomena is governed by Reynolds number and Euler number. Fluid properties are shown in the table : (6)

Water (0^0 C)	Gasoline (20^0 C)
Density = 999.8 kg/m^3 Viscosity = 0.00178 N.s/m^2	Density = 678.78 kg/m^3 Viscosity = 0.00029 N.s/m^2

(b) A vertical, triangular gate with water on one side is shown in Figure- 5. Determine the (04)

resultant force acting on the gate and the location of the centre of pressure.

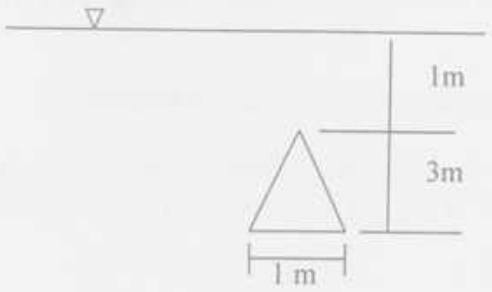


Figure - 5

(c) Determine the magnitude and direction of the resultant force exerted on the double nozzle as shown in Figure- 6. Both nozzle jets have a velocity of 12 m/s. The axis of the pipe and both nozzles lie in a horizontal plane, $\gamma = 9.81$ kN/m^3. Neglect friction. (15)

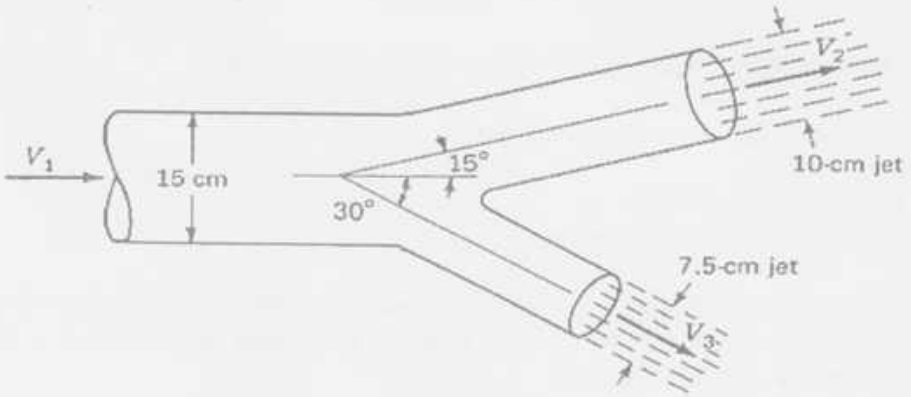


Figure- 6

Section-B

(There are **4 (Four)** questions in this section. Answer any **3 (three)** questions.)

5. (a) Prove Bernoulli's energy equation. Also state its limitations. (8+4=12)

(b) In figure 7, the pipe AB is of uniform diameter. The pressure at A is 125 kN/m^2 and at B is 230 kN/m^2. If a crude oil (S = 0.90) is flowing through the pipe, determine the direction of flow and head loss. (9)

Figure 7

(c) Distinguish between hydraulic grade line and energy line. (4)

6. (a) Write short note on the following terms: (6)
   (i) Head loss
   (ii) Power in fluid flow
   (iii) Critical Reynolds Number

(b) A liquid (S= 0.80) with a P_v= 26 kN/m^2, abs flows through the horizontal constriction as shown in figure 8. P_{atm} = 70 cm Hg. Find the maximum theoretical flow rate without cavitation to occur. Neglect head loss. (14)

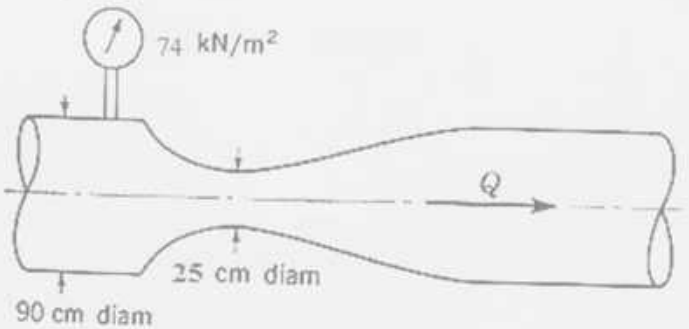


Figure 8

(c) Write down an expression for kinetic energy correction factor. (5)

7. (a) A pipeline 50 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 20 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 = 0.022 for both the pipes. (8)

(b) If the flows into and out of a two-loop pipe system are as shown in figure 9, determine flow in each pipe. The k-values for each pipe are given in figure 9. Use Hardy Cross method. (17)

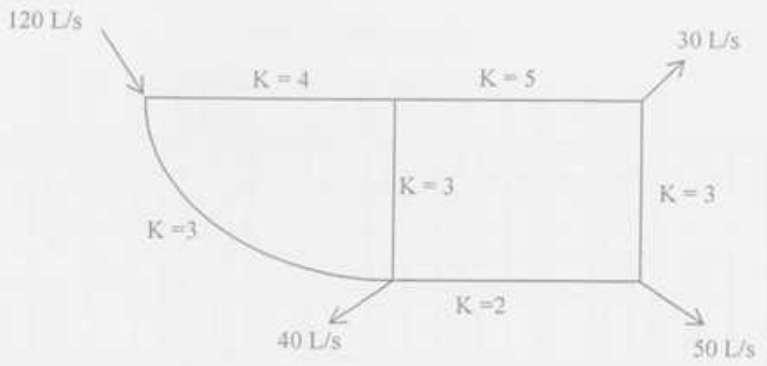


Figure 9

8. (a) Two reservoirs with a difference in water surface elevation of 10 m are connected by two pipes in series as shown in figure 10. The equivalent roughness heights of the two pipes are 2.0 mm and 0.5 mm respectively. Find discharge by equivalent velocity head method. Given $\nu = 2.5\times10^{-6}$ m^2/s. Use Moody diagram (figure 11) for friction factor. (16)

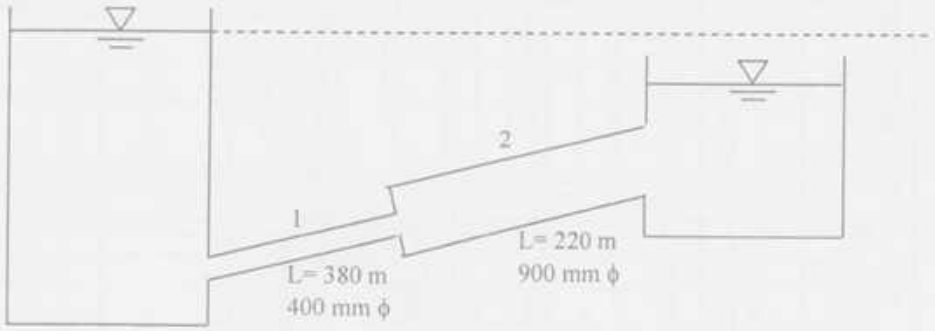


Figure 10

(b) Prove that theoretical discharge through a triangular weir is given by

$$Q_t = \frac{8}{15}\sqrt{2g}\tan\frac{\theta}{2}H^{5/2} \qquad (9)$$

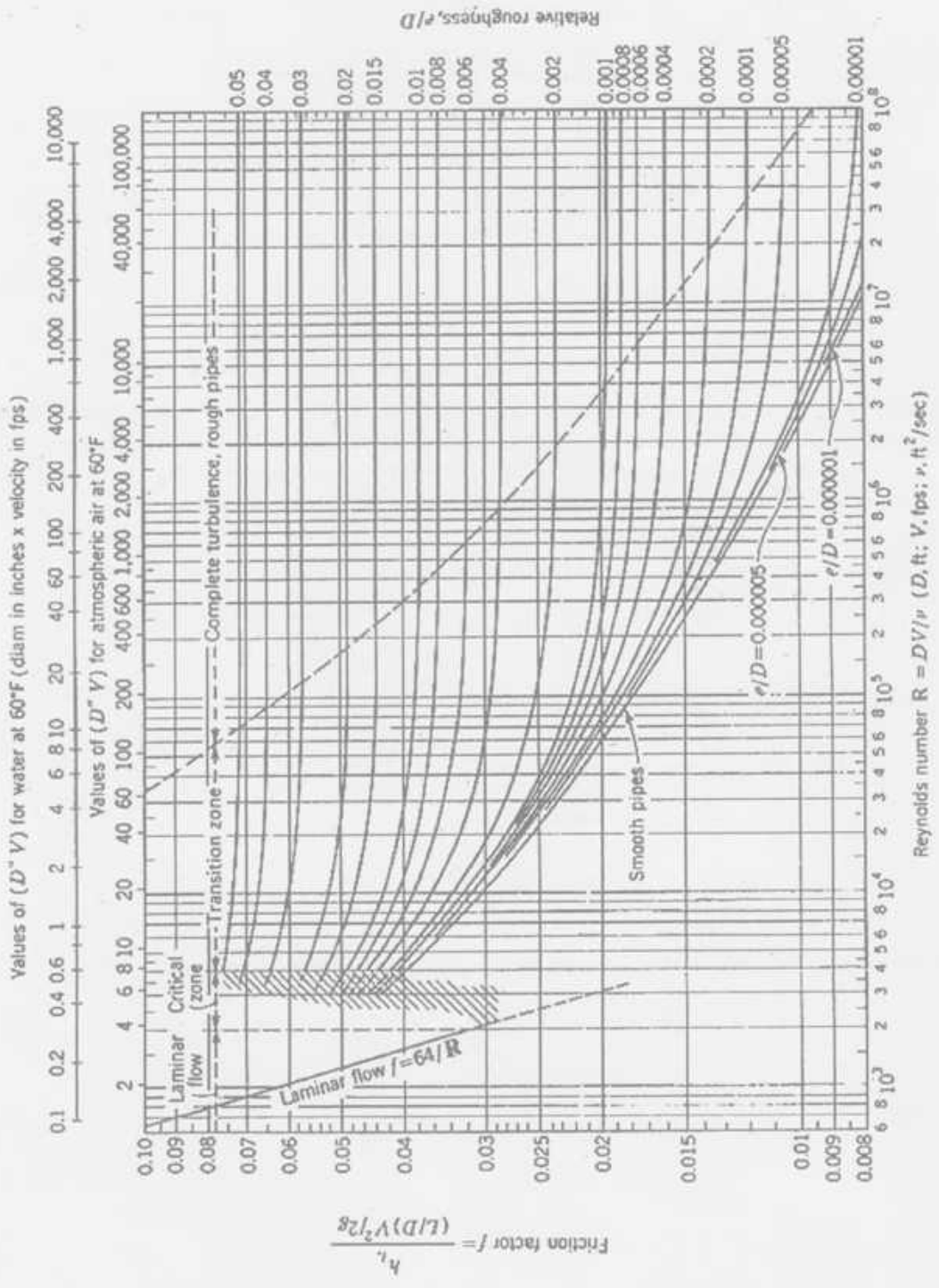


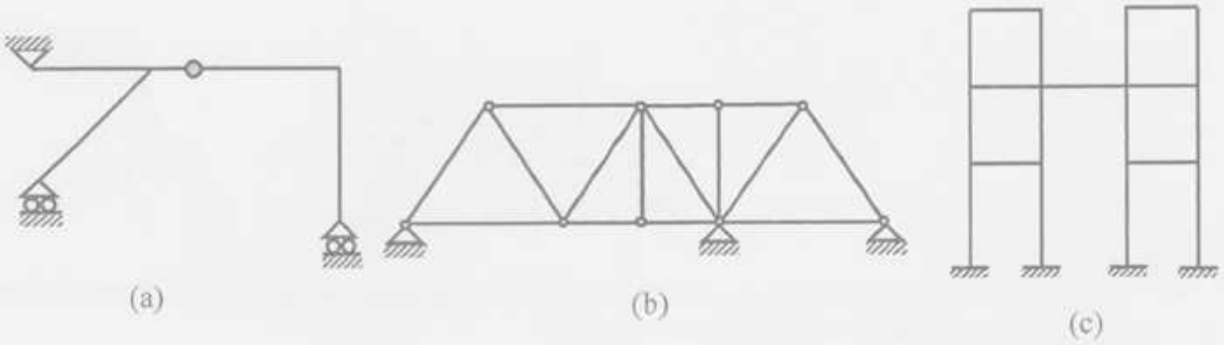
Figure 11: friction factor for pipes (Moody Diagram).

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B. Sc. Engineering (Civil)

Course Title: Structural Analysis & Design I — Course Code: CE 311 (A)
Time: 3.00 Hours — Full Marks: 100 (=10×10)

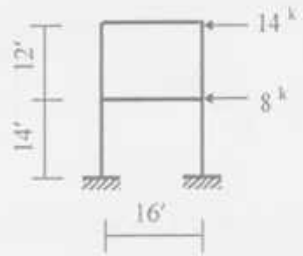
*There are **fourteen (14)** questions in this paper. Answer any **ten (10)**.*
Assume any missing data reasonably.

1. (a) Define degree of indeterminacy.
(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.



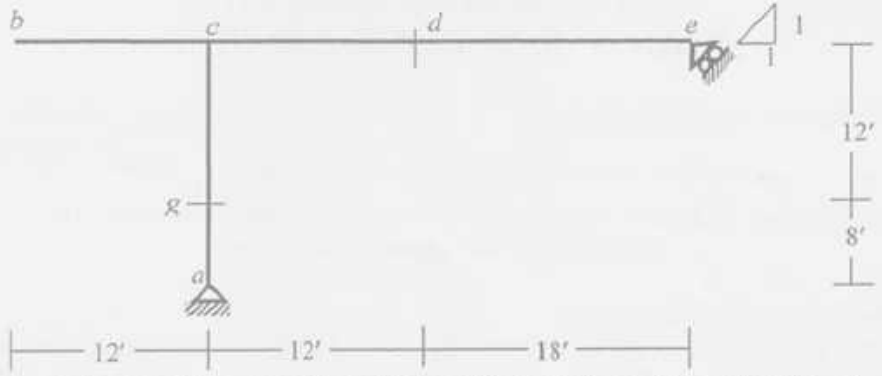
(a) (b) (c)

2. Draw shear force and bending moment diagrams of beams and columns of the two-storied frame subjected to lateral load as shown in the figure, assuming (i) equal share of storey shear forces between columns, (ii) internal hinge at column midspans.

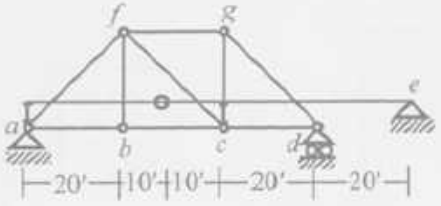


3. In the beam shown below (with internal hinges at B and E), draw the influence lines for
(a) Shear at sections taken an infinitesimal distance to the left and right of support F,
(b) Bending Moments at D and C,
(c) Reaction at A.

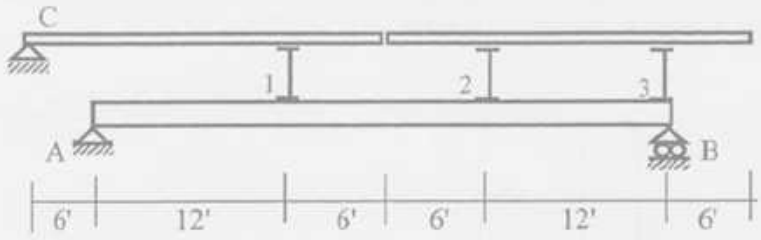
4. For the frame show below, draw the influence lines of V_g, V_d, M_g, M_d and R_a, if the unit load moves over beam *be*.



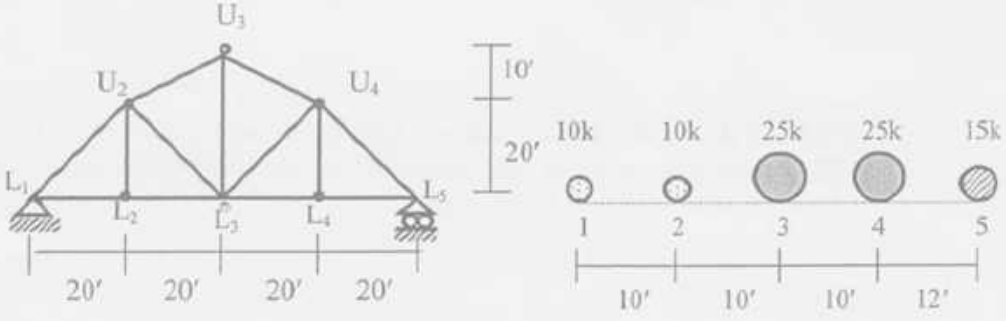
5. For the truss shown below, draw the influence lines for forces in members F_{af}, F_{bf}, F_{cf} and F_{gf}.



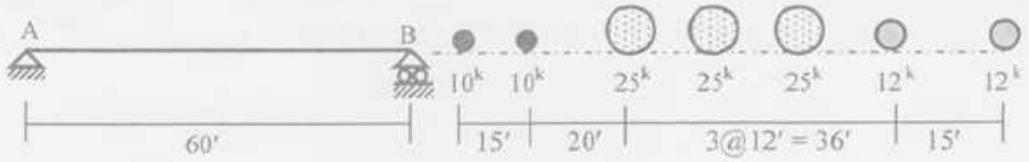
6. Girder AB supports a floor system as shown in the figure below. Draw the Influence line for
   (i) Floor beam reaction at panel point "2"
   (ii) Support reaction at "A"
   (iii) Shear in panel 1-2 and
   (iv) Bending moment for girder at panel point "1".



7. For the truss shown below, calculate the maximum force in member L_2L_3 for the wheel loads shown below (when load moves over bottom cord).



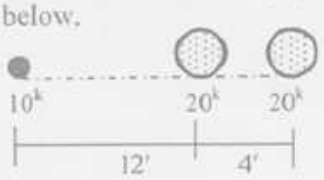
8. Calculate the maximum value of R_A for the wheel load arrangement shown below.



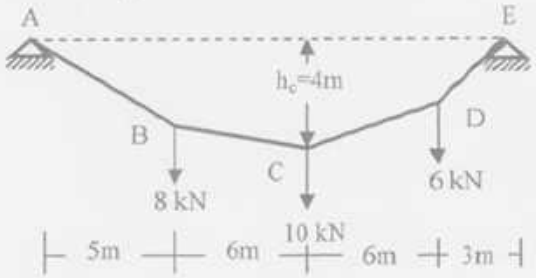
9. Calculate the maximum shear at 20′ right of support A for the beam and the moving loads in *Question 08*.

10. Calculate the maximum moment at mid span for the beam and the moving loads in *Question 08*.

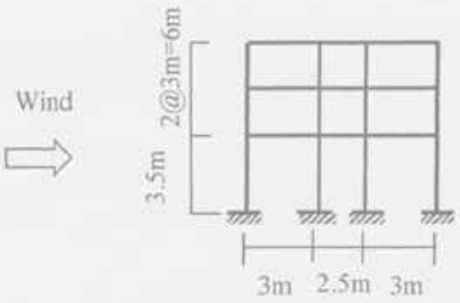
11. Calculate the absolute maximum bending moment of a simply supported beam of span 30 ft due to the wheel loads shown in the figure below.



12. (a) Derive the "general cable theorem".
(b) The cable shown below has supports A and E that lie at the same elevation. Point C on the cable below the chord AE. Use the general cable theorem to determine the sags at B and D.

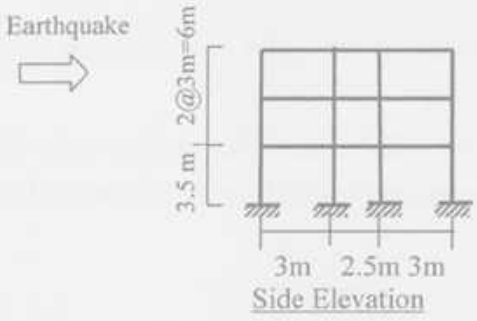


13. Calculate the wind load at each story of a concrete made three-storied hospital building (shown below) located at a flat terrain in Dhaka (Basic wind speed = 210 km/hr). Assume the structure to be subjected to Exposure A.



Side Elevation

14. Calculate the seismic load at each story of a concrete made three-storied hospital building (shown below) located in Dhaka (Zone 2). Assume the structure to be a Special Moment Resisting Frame (SMRF) built on soil condition S_2, carrying a Dead Load of 10 kN/m^2 (Including partition load).



Side Elevation

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc Engineering (Civil)

Course Title: Design of Concrete Structure I | Course Code: CE 315 (B)
Time: 3 hr | Full Marks: 120

Answer any 3 Questions from each section (Assume any missing data)

Section A

1. a) What are the sources of uncertainty in the analysis, design, and construction of reinforced concrete structures, which require a definite margin of safety? (3)
   b) Explain, why the upper limit on ρ should be below ρ_b. (5)
   c) A rectangular beam made using concrete with f'_c = 4000 psi and steel with f_y = 60 ksi has width b=10″, total depth, h = 25″ and effective depth, d = 23″. Concrete modulus of rapture, f_r = 475 psi. The elastic modulus of steel and concrete are, respectively, 29 x 10^6 psi and 3.6 x 10^6 psi. The tensile steel area, A_s = three No. 8 bars in one layer.
   i) Determine the stresses in concrete and steel caused by a bending moment 45 ft-kips.
   ii) Determine the nominal moment M_n (12)

2. a) Explain, why load factors are different for dead and live load? (3)
   b) A rectangular reinforced concrete beam carries service loads on a span of 20 ft as shown in Figure-1. The dead load of 1.6 kip/ft does not include beam weight, f_c' = 3000 psi, f_y = 60000 psi, b=14.5 inch, h = 24 inch and reinforcing is 5 # 9 bar. Determine whether the beam is adequate with respect to moment. (17)

Figure-1

3. Design a rectangular beam for M_D = 325 ft-K and M_L = 400 ft-k if f_c' = 4000 psi and f_y = 60000 psi. The maximum permissible beam dimensions are shown in Figure 2. (20)

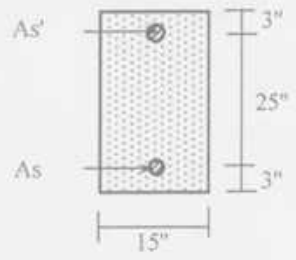
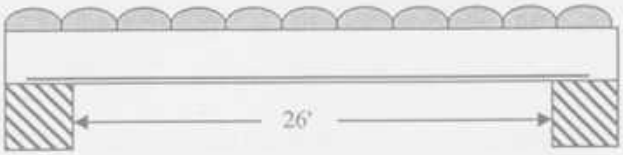
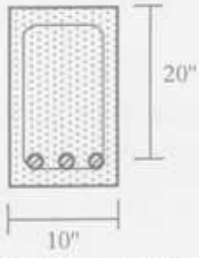


Figure-2

4. Determine the shear reinforcement and stirrup layout for the beam shown in Figure-3. [Given $f_c' = 3000$ psi and $f_y = 60000$ psi] (20)

DL = 1.2 kip/ft (including self weight)
LL = 1.6 kip/ft





Beam cross-section

Figure-3

Section B

5. Design a T beam for the floor system shown in Figure-4. Given, $M_D = 200$ k-ft, $M_L = 425$ k-ft, $f'_c = 3000$ psi, $f_y = 60000$ psi and simple span= 18 ft. (20)

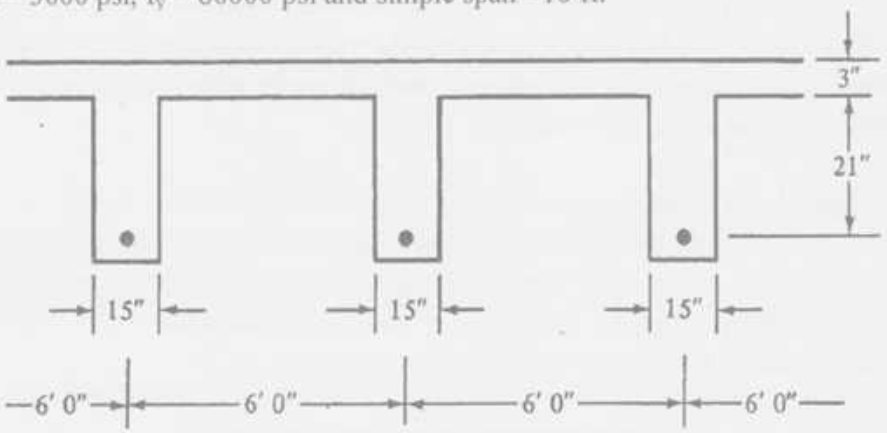


Figure-4

6. a) Write down the ACI specifications for determining the effective width of T-beams and L-beams. (4)
b) Define development length. Mention the factors influencing development length of deformed bars in tension. (6)
c) Determine the tensile development length required for the uncoated #8 bars shown in Figure-5 if normal -weight concrete is used and the bars are straight. Use ACI Equation and compute value of K_{tr}. $f_c' = 4000$ psi and $f_y = 60000$ psi (10)

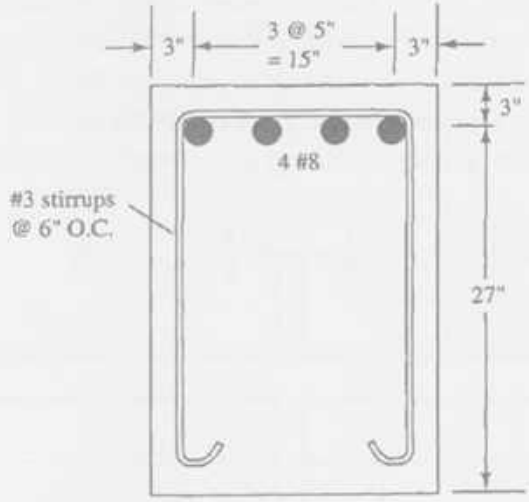


Figure-5

7. a) Determine the development or embedment length required for the epoxy-coated bars of the beam shown in Figure-6.
   i) If the bars are straight, assuming K_{tr} =0.
   ii) If a 180° hook is used.
   iii) If a 90° hook is used.

The six #9 bars shown are considered to be top bars, f_c' = 4000 psi and f_y = 60000 psi (16)

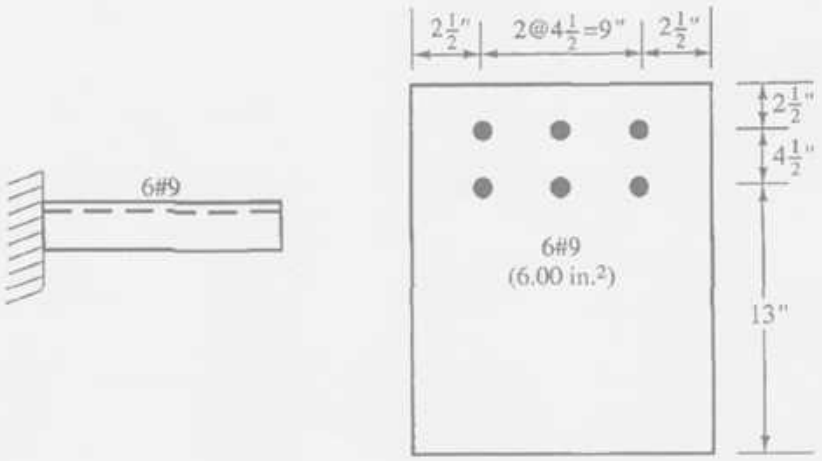


Figure-6

b) Write down the minimum thickness for one-way slab for different support conditions specified by the ACI code. (4)

8. a) A reinforced concrete one way slab is built integrally with its supports and consists of two equal spans. The slab panels are continuous in one direction and each panel has a clear span of 16 ft (Figure-7). The service live load is 100 psf and 4000 psi concrete is specified for use with steel with a yield stress equal to 60000 psi. Design the slab and show the reinforcement detailing. Note, this slab should be okay for serviceability. Use ACI moment co-efficients (shown on the top of the longitudinal slab sections). (18)

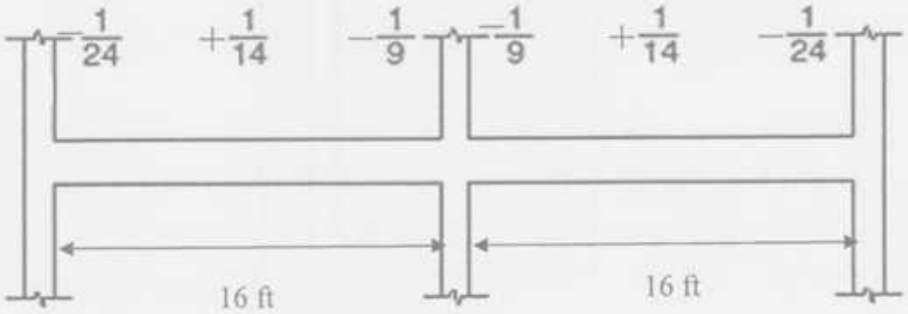


Figure-7

b) How can you differentiate one-way slab with two-way slab? (2)

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Formulae:

Bending:

$$\rho_{max} = 0.85 * \beta_1 * \frac{f_c'}{f_y} * \frac{0.003}{0.003+0.004}$$

$$\rho_{0.005} = 0.85 * \beta_1 * \frac{f_c'}{f_y} * \frac{0.003}{0.003+0.005}$$

$$M_u = \emptyset \rho f_y b d^2 (1 - 0.59 \frac{\rho f_y}{f_c'})$$

$$A_s = \frac{M_u}{\emptyset f_y (d - \frac{a}{2})}$$

$$a = \frac{A_s f_y}{0.85 f_c' b}$$

$$\emptyset = 0.483 + 83.3\epsilon_t$$

$$M_u = \phi(A_s - A_s')f_y\,(d - a/2) + \phi A_s' f_y\,(d - d')$$

$$M_u = \phi A_{s1} f_y\,(d - a/2) + \phi A_{s2} f_y\,(d - d')$$

$$A_{s\,min} = \frac{3\sqrt{f_c'}}{f_y} b_w d$$

nor less than $\frac{200 b_w d}{f_y}$

Shear:

$$V_s = \frac{V_u - \phi V_c}{\phi}$$

$$s = \frac{A_v f_y d}{V_s}$$

$$s = \frac{A_v f_y}{0.75\sqrt{f_c'} b_w}$$

$$\leq s = \frac{A_v f_y}{50 b_w}$$

Compute maximum spacing: $d/2 \leq 24$ in., if $V_s \leq 4\sqrt{f_c'} b_w d$.

Compute maximum spacing: $\frac{d}{4} \leq 12$ in., if $V_s > 4\sqrt{f_c'} b_w d$.

Development Length:

$$l_d = \left(\frac{3}{40} \frac{f_y}{\sqrt{f_c'}} \frac{\alpha\beta\gamma\lambda}{\left(\frac{c + K_{tr}}{d_b}\right)}\right) d_b$$

α = 1.3 for top bar; 1 for bottom bar

β = 1.5, Epoxy – coated bars with cover less than $3d_b$ or clear spacing less than $6d_b$

1.2, All other Epoxy – coated

1, Uncoated bar

γ = 0.8 for #6 and smaller bars

1 for #7 and higher bars

$$K_{tr} = \frac{A_{tr} f_{yt}}{1500 sn}$$

λ = 1.3 for lightweight Aggregate Concrete

1 for for normal weight Aggregate Concrete

$$l_{dh} = \left(\frac{0.02\,\beta\lambda f_y}{\sqrt{f_c'}}\right) d_b$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

Course Title: Design of Concrete Structures II | Course Code: CE 317
Time: 3 hours | Full Marks: 25X6=150

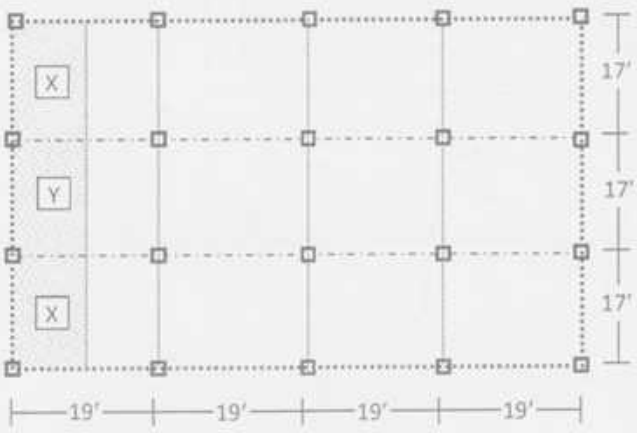
There are 8 (EIGHT) Questions. Answer **any 6 (SIX) Questions including Question No. 1. Question No. 1 is COMPULSORY.**

1. a) What is flat slab? Mention role of Drop Panel, Column Capital, Longitudinal and Transverse Beam in structural design of flat slabs.
   b) Explain why the factors α and φ are used for column design. Mention the ACI recommendations for the size, spacing and arrangement of lateral ties and spirals
   c) What are corner reinforcements in two-way slab? Write down the ACI provision for corner reinforcements.
   d) Show that the ratio of the load shared in the short direction to the long direction of a simply-supported two-way slab is proportional to the forth power of the ratio of the long span to the short span. Simplify the relation for the long span to the short span ratio of 1, 2, 3, and 4.
   e) Explain why is it not advisable to use single piles under columns? Show pile arrangements in different pile groups.

2. Design an exterior corner slab panel of 13 ft by 13 ft (clear span) for the following given condition by USD. [Given, FF = 25 psf, PW=25 psf, LL = 40 psf, f_c'= 3 ksi, f_s = 20 ksi].
   Follow the steps mentioned below in design calculation:

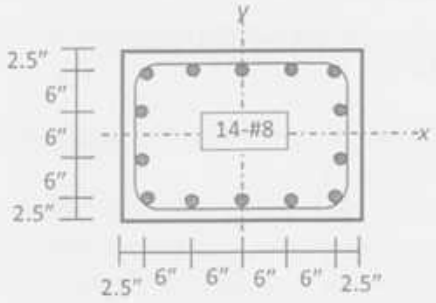
   i. Minimum slab thickness and load calculation,
   ii. Determination of moment coefficient and calculation of design moments,
   iii. Check for slab thickness,
   iv. Calculations of reinforcements,
   v. Check for temperature and shrinkage reinforcements,
   vi. Design for corner reinforcements,
   vii. Layout of reinforcements.

3. 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 X and Panel Y.
   [Given, FF = 25 psf, PW = 30 psf, LL = 50 psf, f_c' = 3.5 ksi, and f_y = 60 ksi]



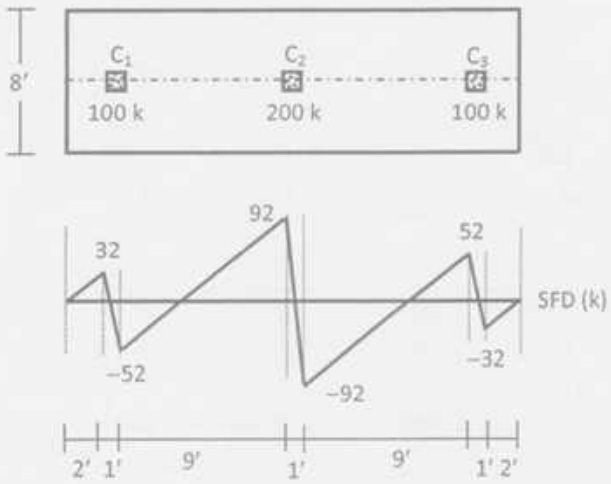
4. For the tied column section shown below [with f_c'= 3 ksi, f_y = 60 ksi] , use the WSD or USD to

   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 = 250 k and b. P = 700 k
   iii. Using Bresler's equation, verify if the sectionis allowed to take P = 350 k along with bending moments M_x = 950 k-in and M_y = 1500 k-in.



5. 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}= 4 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 WSD.
   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. Neat sketches of reinforcements (plan and sections)

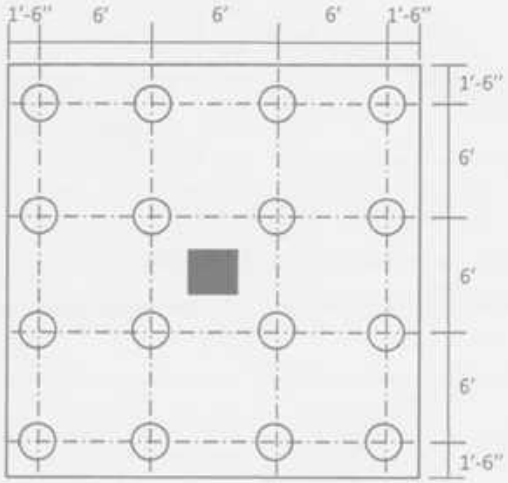
6. The loads (including self-weight) and arrangement of columns of size 12"x12" and the corresponding shear force diagram of the combined footing are shown below. Use WSD to
   i. Draw the bending moment diagram of the footing.
   ii. If the thickness of the footing is 22", check the adequacy of the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



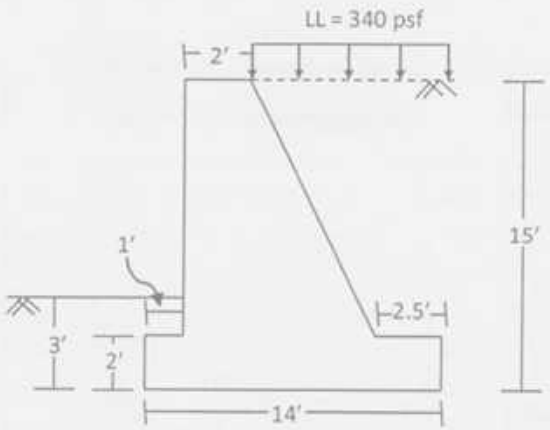
7. The plan of a pile cap with 16 nos. 18" dia piles and the column (24"x24") is shown in the following Figure. Net reaction of a single pile is 60 kip. The total thickness of the pile cap is 48" with average d= 39".
   (i) Calculate the critical punching and beam shear stress,
   (ii) Calculate the design moments,
   (iii) Comment on the adequacy of the thickness

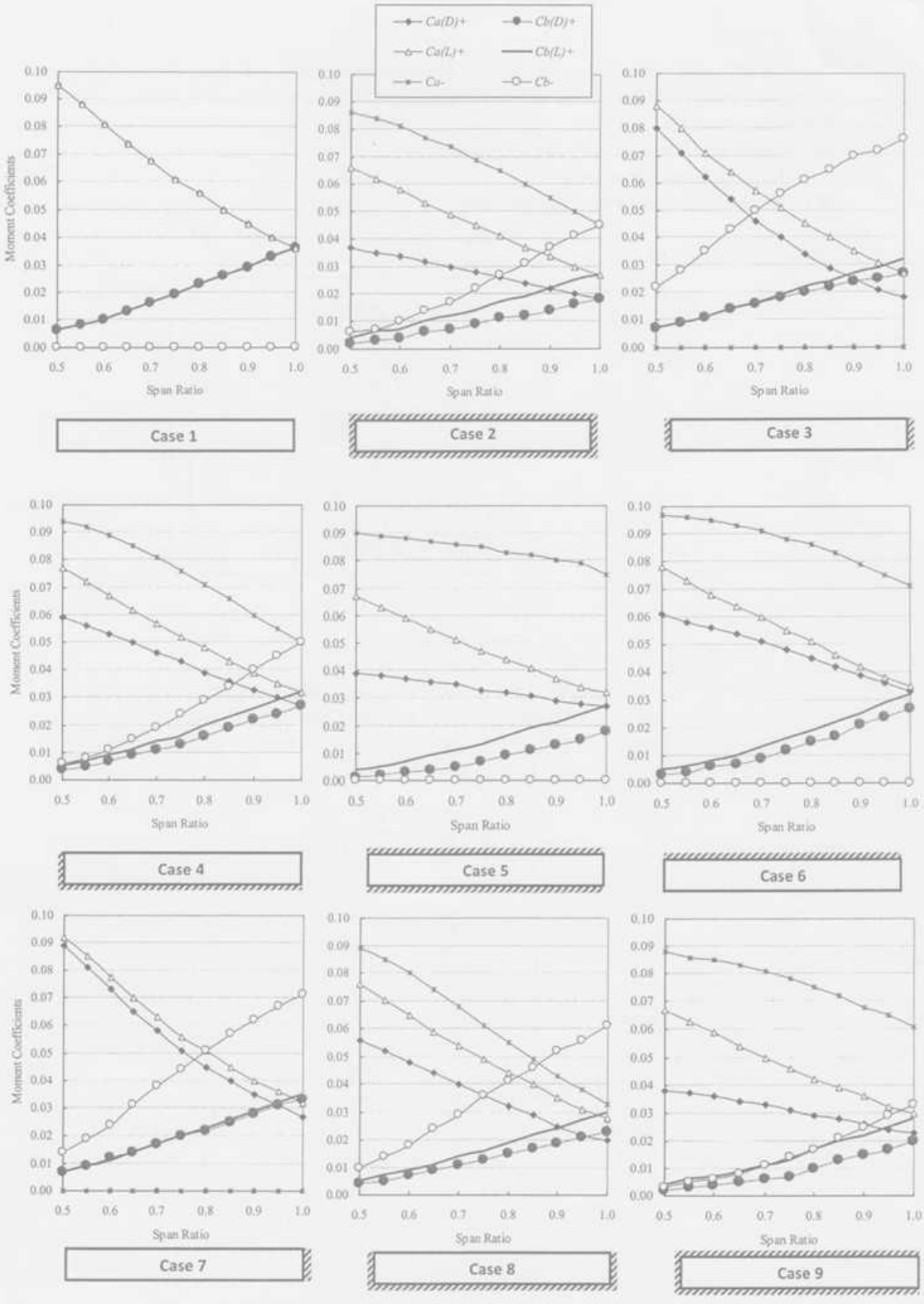
   [Given: f_c'=3 ksi, f_y =50 ksi].

   Use WSD method.



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.]





Moment coefficients for different support conditions

List of Useful Formulae for CE 317

Two way Slab

*$-M_A = C_A \times W_T \times A^2$, *$-M_B = C_B \times W_T \times B^2$

*$+M_A = C_{A(DL)} \times W_{DL} \times A^2 + C_{A(LL)} \times W_{LL} \times A^2$, *$+M_B = C_{B(DL)} \times W_{DL} \times B^2 + C_{B(LL)} \times W_{LL} \times B^2$ *$A_s = M/f_s jd$

* $p_{max} = (0.75 \times p_b) = 0.75 \times 0.85 \times \beta_1 \times (f'_c/f_y) \times [87/(87+f_y)]$ *$R_u = \phi p_{max} f_y [1 - 0.59 p_{max} f_y/f'_c]$

*$R_u = M_u/(\phi b d^2)$ * $A_s = (0.85 f'_c/f_y)[1 - \sqrt{1 - 4R_u/1.7 f'_c}]xbd$

Column-Supported Slabs

*Total Static Moment at Factored Loads, $M_0 = w_u L_2 L_n^2/8$

* Total static moment for interior spans: $M_u^{-} = 0.65\ M_0$, $M_u^{+} = 0.35\ M_0$

* Distribution Factors applied to Static Moment M_0 for Positive and Negative Moments

Position of Moment	Ext Edge unrestrained (a)	Slab with beams between all supports (b)	No beam between interior supports		Exterior Edge fully restrained (c)
			Without edge beam (c)	With edge beam (d)	
Exterior M^{-}	0.00	0.16	0.26	0.30	0.65
Interior M^{-}	0.75	0.70	0.70	0.70	0.65
M^{+}	0.63	0.57	0.52	0.50	0.36

* $\alpha = E_{cb} I_b / E_{cs} I_s$ * $\beta_t = E_{cb} C / 2 E_{cs} I_s$ * $C = \sum (1 - 0.63\, x/y)\, x^3 y/3$

% of Exterior M^{-} supported by Column Strip = $100 - 10\beta_t + 12\,\beta_t\,(\alpha_1 L_2/L_1)\,(1 - L_2/L_1)$

% of M^{+} supported by Column Strip = $60 + 30\,(\alpha_1 L_2/L_1)\,(1.5 - L_2/L_1)$

% of Interior M^{-} supported by Column Strip = $75 + 30\,(\alpha_1 L_2/L_1)\,(1 - L_2/L_1)$

*$A_v = (V_u - V_c)/(f_y \sin\alpha)$ *$S = A_v f_v d/(V - V_c)$

*$V_c = 4\sqrt{f'_c}\, b_o d$ * $V_c = (2 + 4/\beta_c)\sqrt{f'_c}\, b_o d$ * $V_c = (2 + \alpha_s d/b_o)\sqrt{f'_c}\, b_o d$ [Use half of the values for WSD]

Short Column

*$P_n = 0.85 f'_c A_c + f_y A_s = A_g [0.85 f'_c + \rho_s (f_y - 0.85 f'_c)]$

*$P_u = \alpha \phi A_g [0.85 f'_c + \rho_s (f_y - 0.85 f'_c)]$

*$P_{all} = \phi' (0.25 f'_c A_g + f_{call} A_s) = \phi' A_g (0.25 f'_c + \rho_s f_{call})$

*$\rho_s = 0.45 (A_g/A_{core} - 1)\,(f'_c/f_y)$ *$S = 4A_{sp}/(\rho_s d_{core})$

*$P/(P_a) + M/(M_f) = 1$ *$P_a = 0.34 f'_c (1 + \rho_g m) A_g$ *$M_f = 0.45 f'_c S_{st}$

*For symmetrical tied columns, $M_o = 0.40\, A_s f_y (d - d')$, $e_b = (0.17 + 0.67 \rho_g m) d$

*For spiral columns, $M_o = 0.12\, A_{sTotal} f_y (D_s)$, $e_b = (0.14 + 0.43 \rho_g m) d$

*$P/(P_a) + M_x/(M_{fx}) + M_y/(M_{fy}) \le 1$

*$1/P_{xy} = 1/P_x + 1/P_y - 1/P_o$

Footing and Foundation

*$q_{nu} = (1.4DL + 1.7LL)/A_{provided}$ *$V_{fu} = q_{nu} \times$ tributary area *$v_{fu} = V_{fu}/bd$ *$v_{fu(allowable)} = 2\varphi\sqrt{f_c'}$

*$V_{pu} =$ factored load- $q_{nu} \times$ tributary area *$v_{pu} = V_{pu}/b_0 d$ *$v_{pu(allowable)} = 4\varphi\sqrt{f_c'}$

*$A_s = (0.85 f_c'/f_y)[1 - \sqrt{1 - 2M_u/(\varphi \times 0.85 f_c' b d^2)}]bd$ *$v_{f(allowable)} = 1.1\sqrt{f_c'}$ *$v_{p(allowable)} = 2\sqrt{f_c'}$

*$F(x,y) = P/N + M_x y/(\sum y_i^2) + M_y x/(\sum x_i^2)$ *$F = \varphi(a_p f_{call} + a_s f_{soil})$ *$a_s = (P/\varphi - a_p f_{call}) f_{soil}$

*$S_t = (100/0.2)(a_s/a_b)\pi d_c$ *$L_{sp} = P/\{\alpha_2 (\pi d_p) \tau_u\}$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

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

Time: 3.0 hours | Full Marks: 150 (=6×25)

[ANSWER ALL PARTS (i.e. a, b) OF EACH QUESTION TOGETHER]

[Assume reasonable values for any missing data]

SECTION –A

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

1. (a) Briefly explain the essential elements of a sewerage system. (5)

   (b) A composite area consisting of residential area and school (shown in Figure 1) is served by sewer P1. At present the residential area has a total of 50 nos 5 storied building with two flats on each floor. The average occupancy is 5 persons per flat and per capita water demand is 200 liter per day. While, there are 5000 students having waste water generation rate of 70 lpcd in the school. Design the segment of sewer (P1) between man holes MH1 and MH2 serving the composite area using the following data: (20)
   i) pipe length = 300m
   ii) peak factor = 3.0
   iii) peak infiltration rate = 0.25 m^3/ha/day
   iv) Minimum velocity through sewer = 0.75 m/s
   v) Manning's roughness coefficient for sewer is 0.013. The nomograph (Figure 2) is attached with the question paper.
   [Attach the nomograph (Figure 2) for this problem with your answer script]

2. (a) What are the objectives of sewage treatment? (5)
   Briefly describe the unit operations in sewage treatment processes. (7)

   (b) What are the preliminary treatment methods? (5)
   Briefly explain the main operational principles of each of these methods. (8)

3. (a) What are the basic differences of (i) VIP latrine and (ii) Pour-flush pit latrine – with simple pit latrines? (6)
   Which type of pit latrine technology provides hygienic sanitation? Justify your answer. (4)

   (b) Briefly explain the advantages of pour-flush technologies over simple pit latrine. (3)
   Design leach pits for both single pit and alternating twin offset pit pour – flush latrines for a family of 8 members and for a design period of 2 years. The average waste water flow rate is 12 liters per person per day. The soil is porous silty loam with long – term infiltration rate of 20 liters/m^2-day. (12)

4. (a) Briefly describe different types of sedimentation processes. (4)
What are the influencing factors for sedimentation? (5)

(b) Design a waste stabilization pond system to treat domestic sewage generated by 200 people at a rate of 80 mg/L and with a BOD contribution of 400 mg/l. The mean temperature of the coolest month is 20°C and 25°C during irrigation season. It is desired that the final effluent can be used for crop irrigation. Assume faecal coliform concentration in raw waste water to be 1×10^8 per 100 ml. The required effluent standards are FC < 1000 per 100 ml. Assume k and k_b as 0.22 d^{-1} and 2.6 d^{-1} respectively at 20 °C. (16)

SECTION –B

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

5. (a) Define – (i) non-scouring velocity, (ii) self-cleansing velocity and (iii) time of concentration. (3)
What are the changes in design standards for simplified sewerage compared to conventional sewerage system? (5)
What are the requirements to be met by an ideal drain section? (7)

(b) A drainage area, having rain falls during four months of the year only, has an area of 20 ha, with 40 houses/ha. The area has the following surface characteristics: (10)

- The average area of the roof is 60 m^2/house, with runoff coefficient of 0.9.
- The roads occupy 30% of total area. Impermeability factor for these roads could be taken as 0.6.
- The remaining area is open space whose coefficient of runoff may be taken as 0.12.

(i) Determine the dry weather flow from the area if the population is 300 persons/ha and the rate of water supply is 150 lpcd.
(ii) For a rainfall with 40 minutes duration and 5-year return interval, what will be the storm discharge from the area?
(iii) Also find the wet weather flow from the drainage area.

6. (a) Which phase of bacterial growth is important for sewage treatment and why? (3)
Briefly explain the metabolism of bacteria with relevant equations. (3)
What are the proportions of BOD usage during metabolic reactions? (2)

(b) Explain the significance of – (i) high F/M ratio and (ii) low F/M ratio in activated sludge process. (8)
Calculate the effluent BOD from a trickling filter having a depth of 2 m and a recirculation rate of 120 percent of the flow. The influent BOD is 200 mg/L following primary treatment. Laboratory determined value of k is 0.23. Also calculate the BOD removal efficiency of the filter. Again, to increase the BOD removal efficiency from trickling filter by 10%, what will be the BOD removal percentage from the influent received through primary treatment? (9)

7. (a) Briefly explain the principal methods for sewage and sludge disposal. (6)
What are the collection points for sludge? (5)

(b) What is anaerobic digestion? What are the purposes of anaerobic digestion? (6)
Describe the stages in anaerobic digestion of sludge. Show the metabolic pathways for anaerobic digestion. (8)

8. (a) Briefly explain the biological treatment mechanism. (3)
Write the role of bacteria in biological treatment. (4)

(b) What are the conditions to make a choice between separate and combined sewer systems? (8)
Define – (i) Sanitary sewage (ii) Sullage (2)
Using the enclosed hydraulic elements diagram (Figure 3), determine the velocity and discharge in a 20 inch diameter circular sewer when flowing half full and when the depth of flow is equal to 10 inch. Given, n= 0.013 and slope S = 0.015. (8)
[Attach the diagram (Figure 3) for this problem with your answer script]

Formulae:

$$C_e = \left(\frac{C_i + rC_e}{1+r}\right)e^{-kD}$$

$Q = FCIA$

$\lambda_v = L_i Q / V_s, \qquad \lambda_s = 10 L_i Q / A,$

$$N_e = \frac{N_i}{1+k_b t} \qquad N_e = \frac{N_i}{(1+k_b t_a)\times(1+k_b t_f)\times(1+k_b t_m)^x}$$

$t_m = \{[N_i / N_e (1+k_b t_a)(1+k_b t_f)]^{1/n} - 1\} / k_b$

$k_{b(T°C)} = k_{b(20°C)} \times (1.19)^{T-20}, \qquad k_{(T°C)} = k_{(20°C)} \times (1.05)^{T-20}$

$V = 1.486(R^{2/3}S^{1/2})/n, \qquad D = (2.16Qn/\sqrt{S})^{3/8}$

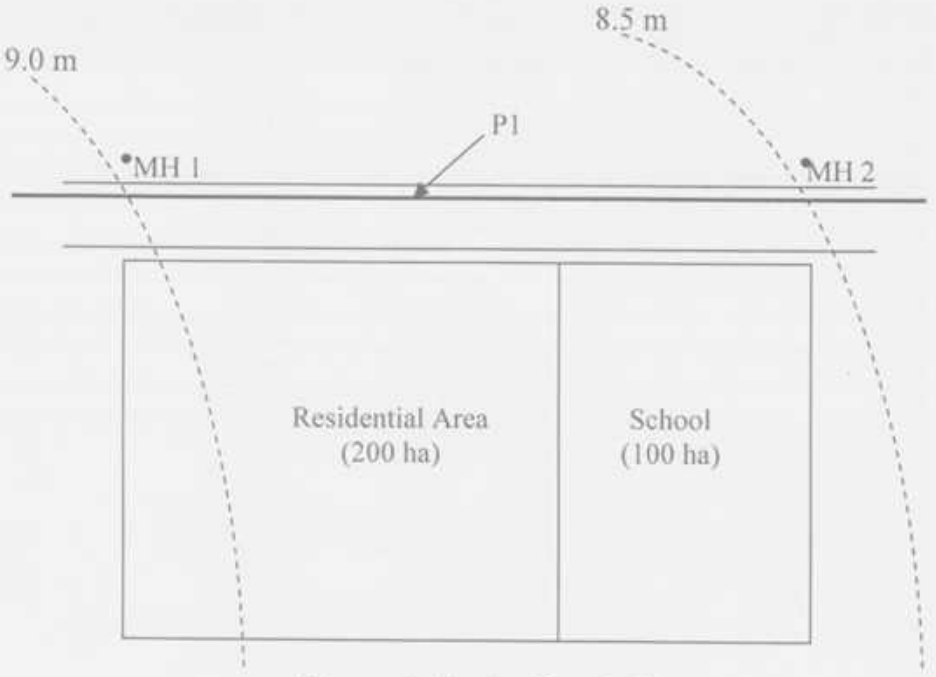


Figure 1: For Problem 1 (b)

Table 1: Design values of λ_v and BOD removal rate at various temperatures

Temperature (° C)	Volumetric Loading Rate, λ_v (g/m^3 d)	BOD removal (%)
≤ 10	100	40
11	120	42
12	140	44
13	160	46
14	180	48
15	200	50
16	220	52
17	240	54
18	260	56
19	280	58
20	300	60
21	300	62
22	300	64
23	300	66
24	300	68
≥ 25	300	70

Table 2: Design values for surface BOD loading rates for facultative ponds at various temperatures

Temperature (°C)	Surface loading rate, λ_s (kg/ha d)	Temperature (°C)	Surface loading rate, λ_s (kg/ha d)
10	100	20	253
11	112	21	272
12	124	22	292
13	137	23	311
14	152	24	331
15	167	25	350
16	183	26	369
17	199	27	389
18	217	28	406
19	235	29	424

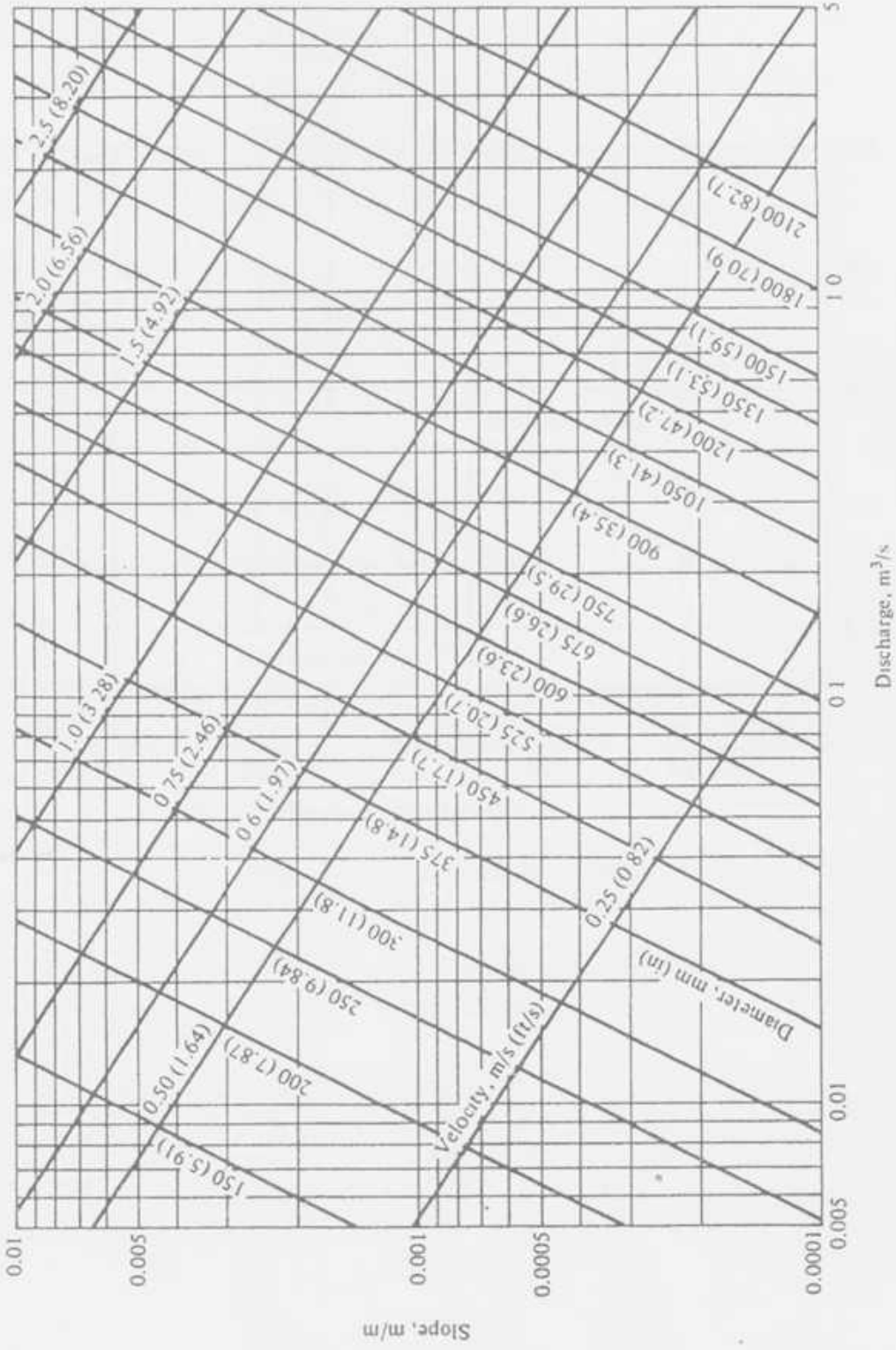


Figure 2: Nomograph for solution of Manning's equation for n = 0.013

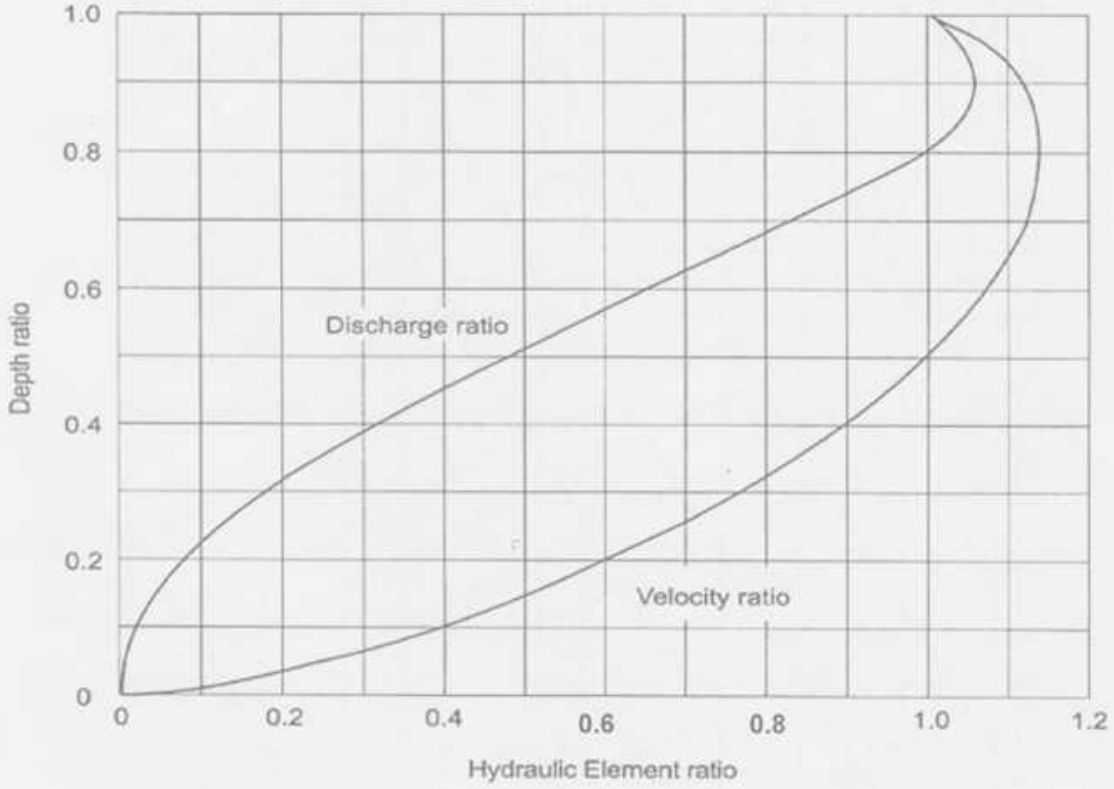


Figure 3: Hydraulic elements diagram

3-1

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
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. (4x13=52 marks)

1. a) Define: (i) Effective unit weight, (ii) Degree of saturation, (iii) Coefficient of permeability 3
   b) Derive the expression relating degree of saturation (S), void ratio (e), water content (w) and specific gravity (G_s). 4
   c) Name the two standard laboratory tests of compaction. 1
   d) Draw typical compaction curves for both the standard tests. 2
   e) Calculate coefficient of volume compressibility. Given that, the change in void ratio is noted 0.1 due to 300 kN/m^2 increase of pressure in the saturated clay layer. Initial void ratio was 1.12. 3

2. a) Define: (i) Effective size, (ii) Plasticity Index, (iii) Void ratio 3
   b)Draw a flownet under a dam. The flownet should have 3 flow channels and 7 equipotential lines. 3
   c) Describe the role of moisture content in soil compaction. 2
   d) Draw a typical Mohr circle representing unconfined compression test result. 2
   e) Calculate the time required to complete 70% consolidation for a 5 m deep saturated clay layer which is subjected to one-way drainage. A sample from the mid depth from that layer took 3 days to complete 70% consolidation in the oedometer test setup. 3

3. a) Define: (i) Over-consolidation ratio, (ii) Compression index, (iii) Specific Gravity 3
   b) Discuss on different states of soil and limiting water contents (Atterberg's limits). 2
   c) Draw typical shear stress vs shear displacement curve for loose and dense sand. 3
   d) Name four factors influencing the method of compaction. 2
   e) Draw the Mohr circle and the Mohr failure envelope for unconfined compression test at failure. Also calculate cu. Given that, unconfined compressive strength is 200 kPa. 3

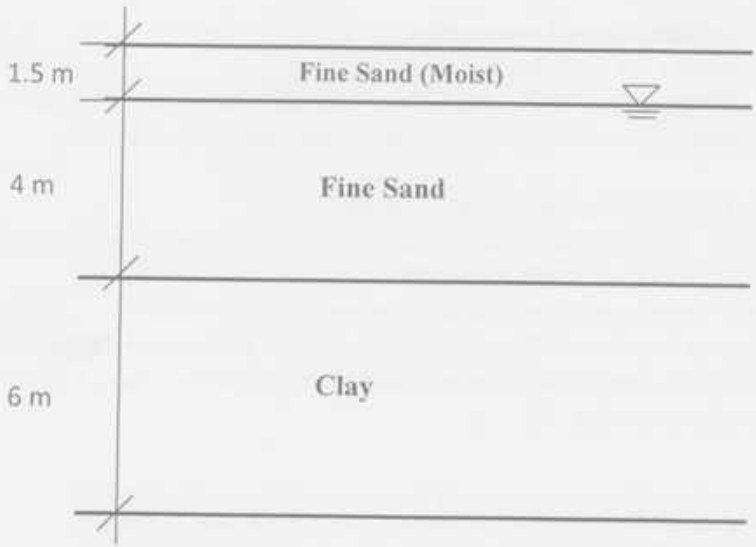
4. a) Define C_c and C_s using e – logσ' curve. 3
   b) What is Darcy's Law? When is this law valid for soil? 2
   c) Draw two Mohr circles representing active and passive earth pressure failure states and the Mohr-Coulomb failure envelope for a cohessionless soil.Write the coordinates of the points on the circle, located on the x-axis. 3
   d) What are the shear strength parameters? Show their relation graphically. 2
   e) Derive the expression of coefficient of permeability for falling head permeability test apparatus. 3

5. a) Define: (i) Transported soil, (ii) Coefficient of compressibility, (iii) Time Factor 3
   b) Derive the expression of computing settlement for normally consolidated soil. 5
   c) Calculate Coefficients of earth pressure under active and passive conditions (K_a and K_p). Given that $K_0 = 0.4$. 2
   d) Write the expressions and also estimate the values of lateral earth pressure for c-φ backfill soil under active and passive conditions. Given that, effective overburden pressure is 250 kPa, c = 5 kPa and $\varphi = 32^\circ$. 3

Section B

There are eight questions. Answer any 6 questions. **(6x8 = 48 marks)**

6. A clay stratum of thickness 6 m is located at a depth of 5.5 m below the ground surface. It is overlain by fine sand. The water table is located at a depth of 1.5 m below the ground surface. For saturated fine sand, effective unit weight and the dry unit weight are 9.4 and 15 kN/m^3, respectively. The water content in the moist fine sand (having $G_s = 2.7$) is 12%. Draw the total stress and the pore water pressure diagrams for the following soil profile.



7. A concentrated load of 15 kN acts on the surface of a soil mass. Applying Boussinesq equation $[\sigma_z = \frac{3Q.z^3}{2\pi.(r^2+z^2)^{5/2}}]$.

(i) Draw horizontal stress distribution at 4 m below the surface;

(ii) Determine the depth (on the axis of loading) where vertical stress reduces to 20% of the load applied.

8. Classify the following soils:

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

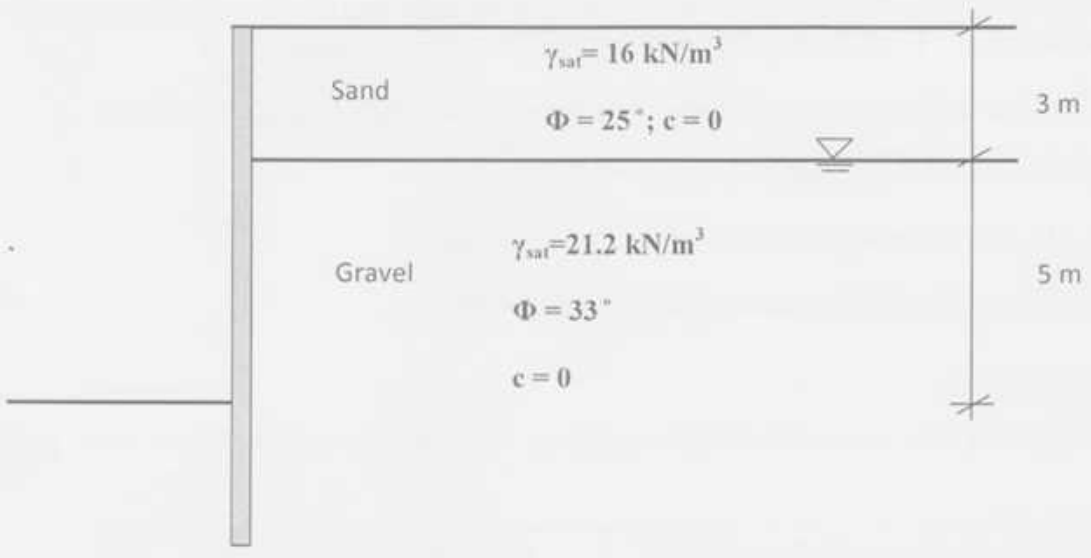
Percent finer than 0.075 mm = 55%
Percent of coarse fraction passing 4.75 mm sieve = 60%
Liquid limit = 52%
Plastic limit = 35%

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

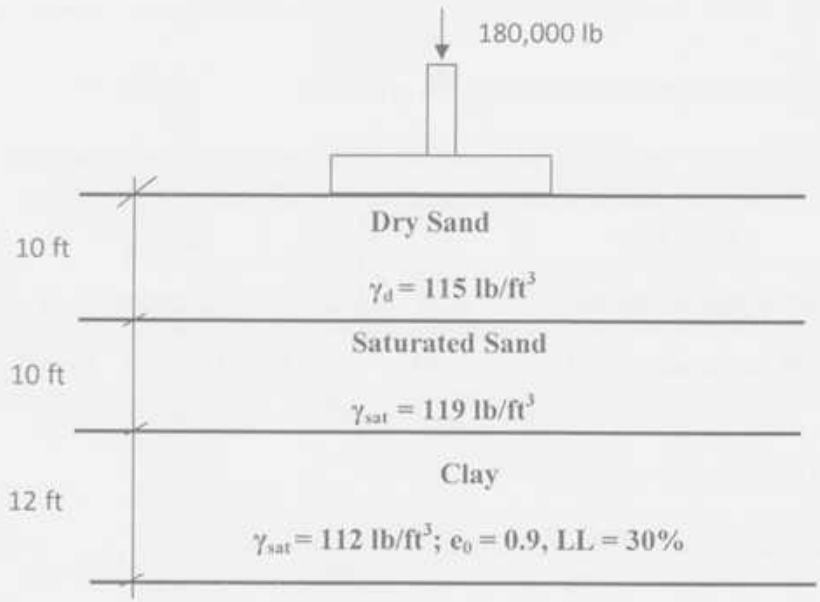
Percent of soil material in the pan = 10%
Percent of coarse fraction passing 4.75 mm sieve = 60%

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%
Plastic limit = 20%

9. Make a sketch of the distribution of active pressure on the wall. Compute the total active force by the 8 m deep backfill soil on the wall (per unit length of the wall). Also determine the line of action of the resultant.



10. 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 6 ft x 6ft. 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, $\Delta\sigma = (2\,\Delta\sigma_t + 4\,\Delta\sigma_m + 3\,\Delta\sigma_b) / 9$

10. Compute OCR and pre-consolidation pressure at point A in the following timeline. Sketch e-logσ' curve of the soil element at point A. The following data represents the stress-states of point A.

(a) In the year 2007, the soil, supporting a structure, was normally consolidated. $\sigma_{present}' = 650$ kPa.

(b)In 2010, the old structure was demolished. $\sigma_{present}' = 250$ kPa.

(c) In January 2011, new construction commenced. $\sigma_{present}' = 240$ kPa.

(d) In 2014, due to progress of the construction project, $\sigma_{present}' = 380$ kPa.

12. Triaxial compression tests were conducted on a specimen . All tests were run slowly, permitting complete drainage.

Deviator stress at failure (kN/m^2)	Confining pressure (kN/m^2)
331	481
155	231
133	131
119	53

Determine shear strength parameters for the given soil.

13. A Standard Proctor test conducted on a sample of soil gave the following results:.

Trial No.	1	2	3	4	5
Bulk density (g/cm3)	2.06	2.13	2.15	2.16	2.14
Water content (%)	12.85	14.28	15.65	16.86	17.89

Volume of mold = 950 cc; $G_s = 2.65$.

Find the maximum dry density and the optimum moisture content.

University of Asia pacific
Department of Civil Engineering
Final Examination Spring 2014
CE 351: Transportation Engineering I (Transport and Traffic Design)

Full Marks: 150 **Time: 3 Hours**

Instructions:

1. Use separate scripts for each section.
2. Figures in the right margin indicate marks for each question.
3. Notations and symbols used here carry their usual meanings.
4. Assume reasonable values for missing data.

Section-A

(Answer any three questions)

1. a) The following data were observed for 6 vehicles traversing 5 mile segment of a highway. Calculate the Time Mean Speed and the Space Mean Speed of the vehicles. 8

Vehicle	Time (min)
1	4.7
2	3.8
3	3.9
4	4.2
5	5.3
6	4.8

b) Define the following terms: 8
   i) Safe speed ii) Design speed
   ii) Median speed iv) Modal speed

c) Define Traffic Calming Devise. List some traffic calming devises and explain anyone of them. 9

2. a) Compare angular and parallel method of parking. 8
   b) What are the points to be considered for selecting the site of parking? 4
   c) Write down the advantage and disadvantage of common method of on-street parking. 6
   d) Calculate the AADT for the following data. Data was collected on Monday in June. MEF for June is 0.578. 7

Hour	Volume
6:00-7:00 a.m.	600
7:00-8:00 a.m.	865
8:00-9:00 a.m.	720
9:00-10:00 a.m.	980
10:00-11:00 a.m.	700

3. a) Write short note on any three: 12
   (i) Park and ride system
   (ii) Recurrent delay
   (iii) Special Mandatory Traffic Sign
   (iv) Variable Message Sign (VMS)

   b) Design a two-phase signal at an isolated cross-junction for the following data: 13
   Intergreen for N-S: 9 sec and E-W: 6 sec.
   Lost time due to starting and end delays : 3 sec (N-S) and 2 sec (E-W)

	N	S	E	W
Flow(q), veh/hr	650	610	860	790
Saturation flow(s) veh/hr	2200	2350	2690	2750

   Assume any missing data. Draw bar diagram.

4. a) What are the common methods of collecting origin and destination data? 6
   b) What are the objectives of origin and destination survey? 6
   c) Two straight sections of a highway meet at an angle of 145^0. If the radius of simple circular curve is 800m, find 13
   i) Mid-ordinate
   ii) Apex distance,
   iii) Tangent distance and
   iv) Length of long chord

Section-B

(Answer any three questions)

5. a) Explain the relationship between mobility and accessibility in terms of highway classification. 9
   b) An existing crest vertical curve on a highway connects a +3% grade with -4% grade. If the design speed of the highway is 70mph determine the length of the curve. 16

   If a sag vertical curve, which will join a -3% grade to +4% grade, what will be the minimum length of the curve. Assume the same speed limit.

6. a) Write short notes on any **four**: 12
   i) Stopping sight distance
   ii) Skid resistance
   iii) Braking distance
   iv) Glare recovery
   v) Visual acuity

   b) A horizontal curve with a radius of 700 ft is designed for a two-lane highway that has a posted speed limit of 55 mph. If the highway is level at this section determine the minimum distance that any roadside object can be placed from the centerline of the inside lane of the curve. Assume PR time 2.5 sec and friction factor 0.4. 13

7. a) What are the main components that influence highway geometric design? 5
   b) List any ten important functions of shoulder. 10
   c) A student test the braking ability of his car determined that he needed 32 ft more to stop his car when driving down hill on a particular road than when driving uphill at 55 mph. Assume coefficient of friction 0.30. Determine the braking distance downhill and the grade of the highway at that section of the road. 10

8. a) Shortly describe the factors effecting the development of transportation system in Bangladesh. 10
   b) Briefly explain different types of transportation related problems in Bangladesh. 10
   c) Explain the function of transportation in political development of Bangladesh. 5

Tables for Question 2(b)

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

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2014
Program: B. Sc. Engineering (Civil)

Course Code: CE 361 | **Full Marks: 150**
Course Title: Open Channel Flow | **Time: 3 hours**

There are four (4) questions in each section. Answer any three (3) questions from each section (25×6=150)

Section A

Answer any three (3) questions from the following. (25×3 = 75)

1. (a) Define specific energy and total energy with expressions. [6]
   (b) Obtain the relationship among Chezy's "C", Darcy Weisbach friction factor "f" and Manning's "n". [7]
   (c) What is critical flow? How can section factor be computed for critical flow? [2+2]
   (d) For a trapezoidal channel with b = 6m and s =2, compute the critical depth and velocity if Q = 50 m^3/s. Take $\alpha = 1$. [8]

2. (a) Define uniform flow. Explain why the flow in a long straight prismatic channel under normal condition always tends to be uniform? [2+6=8]
   (b) Write down the factors affecting Manning's "n". [5]
   (c) By using Lacey's method, design a stable alluvial channel when d= 0.15 cm and the discharge is 25 m^3/s. [12]

3. (a) What do you mean by "Best Hydraulic Section"? Show that the hydraulic depth of a best hydraulic rectangular section is equal to the depth of flow. [2+6= 8]
   (b) Differentiate between "minimum permissible velocity" and "non-erodible velocity". [5]
   (c) Design the best hydraulic trapezoidal section built with non-erodible bed to carry a discharge of 20 m^3/s on a slope of 1 in 1000 if n = 0.025. [12]

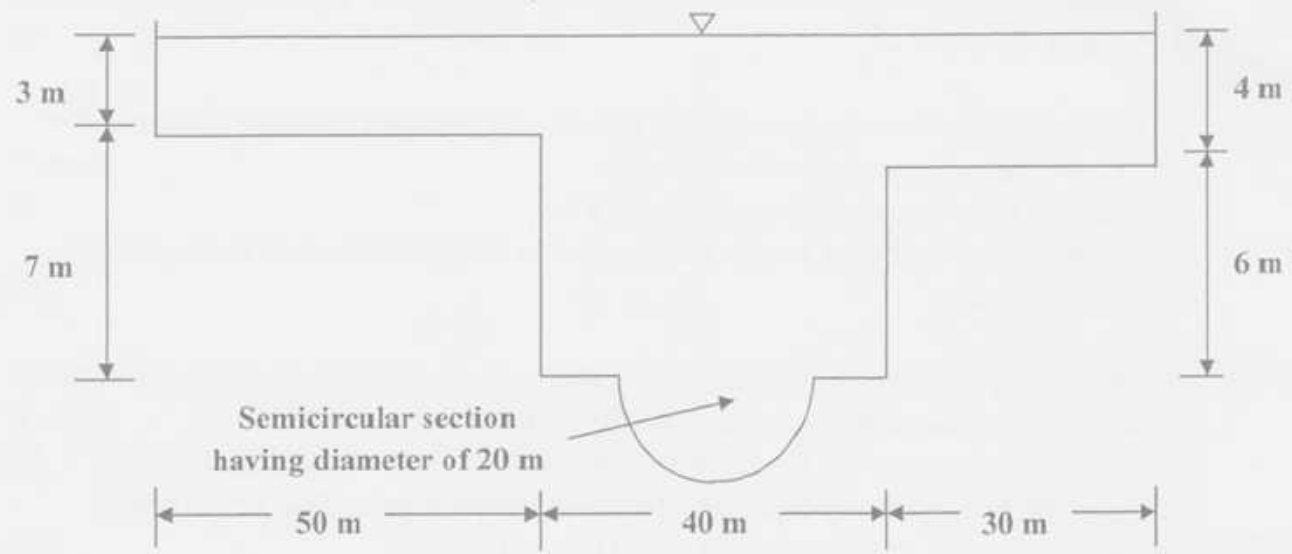
4. (a) Derive Horton's formula to compute the equivalent roughness value for composite channel section. [10]
   (b) An irrigation canal has to carry a discharge of 30 m^3/s through a coarse non-cohesive material having d_{50} = 2.5 cm, d_{75} = 3.0 cm and n = 0.025. The angle of repose of the perimeter material is 32°. The canal is to be trapezoidal in shape having s = 2 and laid on a slope of 1 in 1000. Determine section dimensions of the channel. Use Lane Method. [15]

Section B

Answer any three (3) questions from the following. (25×3 = 75)

5. (a) Define hydraulic jump. Classify hydraulic jump based on Froude Numbers. [2+5=7]
   (b)Water flows at a depth of 1 m in a horizontal trapezoidal channel having a base width of 5.0 m, side slope 1:1 and discharge 30 m^3/s. If a hydraulic jump occurs in the channel, compute the sequent depth and relative energy loss in the jump. [12]
   (c) Write down the practical applications of hydraulic jump. [6]

6. (a) Mention practical occurrence (example) for each of the following profiles :
   i) M1 Profile, ii) M2 profile, iii) S2 profile, iv) M3Profile, v) S3 profile [10]
   (b) A channel consists of a main section and two side sections as shown in the following figure. Compute the total discharge, the mean velocity of flow and the Manning's n for the entire section when n = 0.025 for the main channel, n = 0.045 for the side channels and S_o= 0.0002. Also compute the numerical values of α and β for the entire section assuming that α = β = 1.00 for the main channels and the side sections. [15]



7. (a) Draw the profiles for following channel conditions:
(i) A mild slope followed by a steep slope, (ii) Mild slope followed by a free overfall, (iii) upstream and downstream of a sluice gate in a steep slope channel, (iv) A mild slope followed by a steeper mild slope. [2 × 4 =8]
(b) What parameters are needed to compute the 'conveyance' for a channel section? [3]
(c) A rectangular testing channel is 0.65 m wide and is laid on a slope of 0.1%. When the channel bed and walls were made smooth by neat cement, the measured normal depth of flow was 0.45 m for a discharge of 0.25 m^3/s. The same channel was then roughened by cemented sand grains and the measured normal depth was 0.35 m for a discharge of 0.15 m^3/s. Determine the discharge for a normal depth of 0.55 m if the bed is roughened and the walls are made smooth. [14]

8. (a) A rectangular channel 6 m wide has three reaches arranged serially. The bottom slope of the reaches are 0.016, 0.015 and 0.0064. The n values for the three reaches are 0.020, 0.015 and 0.025 respectively. For a discharge of 20 m^3/s, sketch the resulting flow profiles. [15]

(b) Mention the resulting types of curve (drawdown or backwater) and the resulting types of flow (subcritical or supercritical) for the following depth relations in the given types of channel slopes: [10]
i) Mild slope channel, $h_n > h > h_c$
ii) Mild slope channel, $h_n > h_c > h$
iii) Steep slope channel, $h > h_c > h_n$
iv) Steep slope channel, $h_c > h > h_n$
v) Steep slope channel, $h_c > h_n > h$

Given Formulas

$\overline{U} = \frac{\int_0^A u\, dA}{A}$ $\alpha = \frac{\int_0^A u^3\, dA}{\overline{U}^3 A}$ $\beta = \frac{\int_0^A u^2\, dA}{\overline{U}^2 A}$	Trapezoidal channel $A = (b + sh)h$ $P = b + 2h\sqrt{1+s^2}$ $B = b + 2sh$	Circular Channel $h = \frac{d_o}{2}\left[1 - cos\frac{\omega}{2}\right]$ $\omega = 2cos^{-1}\left(1 - \frac{2h}{d_o}\right)$ $A = (\omega - sin\omega)\frac{d_o^2}{8}$ $B = d_o \sin\frac{\omega}{2}$ $P = \frac{\omega d_o}{2}$ *Note that ω is in radian*

$$\alpha = \frac{\alpha_1 K_1^3/A_1^2 + \alpha_2 K_2^3/A_2^2 + \alpha_3 K_3^3/A_3^2}{K^3/A^2}$$

$$\beta = \frac{\beta_1 K_1^2/A_1 + \beta_2 K_2^2/A_2 + \beta_3 K_3^2/A_3}{K^2/A}$$

$$n = \left(\frac{P_1 n_1^{3/2} + P_2 n_2^{3/2} + P_3 n_3^{3/2}}{P}\right)^{2/3}$$

Formula for Lacey's Method:

$$f_s = 1.76\sqrt{d}$$

$$S_0 = \frac{f^{5/3}}{3340 Q^{1/6}}$$

$$R = 0.47\left(\frac{Q}{f_s}\right)^{1/3}$$

$$P = 4.75\sqrt{Q}$$

Lane Method: $_b = 0.40\, d_{75}$

$$K = \frac{s}{b} = \sqrt{1 - \frac{sin^2}{sin^2\Psi}}$$

For Hydraulic Jump:

$$\frac{h_2}{h_1} = \frac{1}{2}\left(\sqrt{1 + 8F_{r1}^2} - 1\right)$$

$$h_L = \frac{(h_2 - h_1)^3}{4h_1 h_2}$$

$$\frac{E_2}{E_1} = \frac{(1 + 8F_{r1}^2)^{3/2} - 4F_{r1}^2 + 1}{8F_{r1}^2(2 + F_{r1}^2)}$$

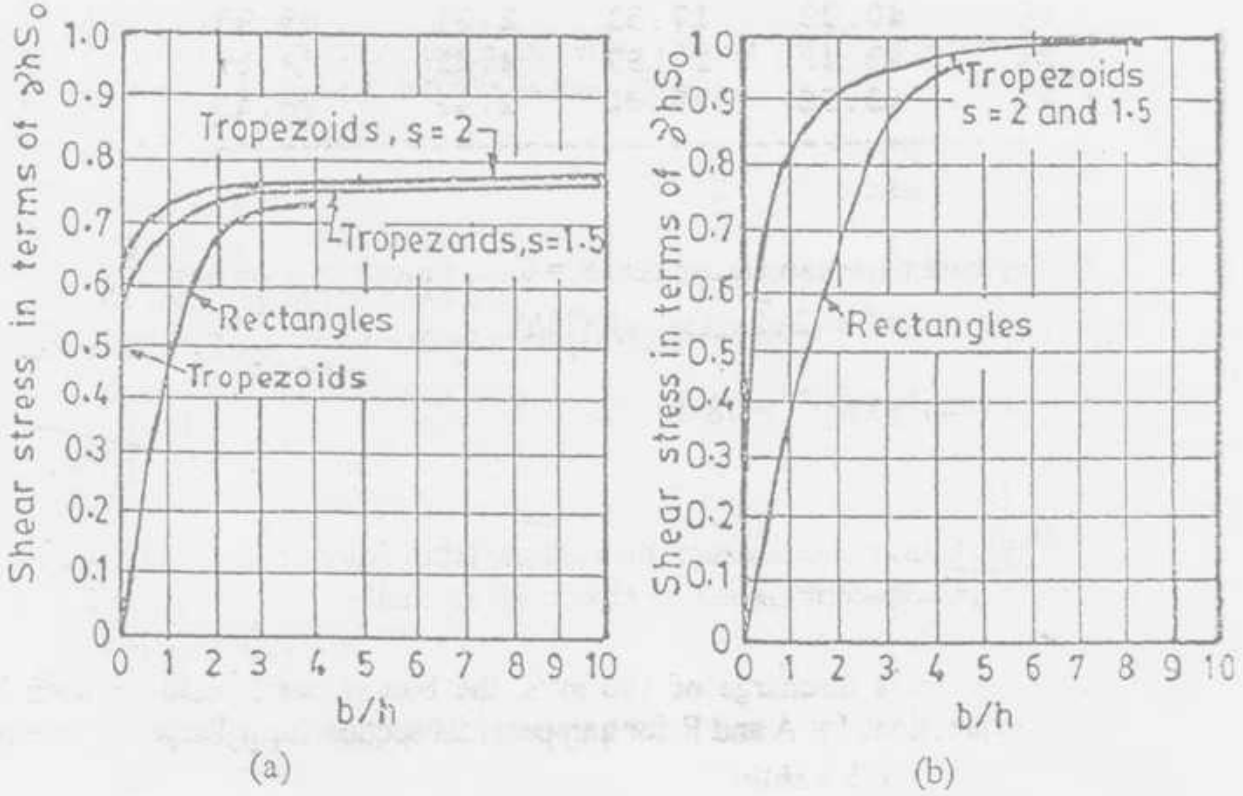
$$\frac{h_j}{E_1} = \frac{\sqrt{1 + 8F_{r1}^2} - 3}{2 + F_{r1}^2}$$

$$L_j = 9.75h_1(F_{r1} - 1)^{1.01}$$

$$F_2 = \frac{Q^2}{gA_2} + \overline{z}_2 A_2$$

For trapezoidal channel ,$\overline{z} = \frac{h}{6}\left(\frac{3b+2sh}{b+sh}\right)$

Maximum Shear Stress on (a) sides and (b) bottom of channel



University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2014
Program: B. Sc Engineering (Civil)

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

Section A
There are FOUR questions answer any THREE
(Assume any reasonable data if not given)

1. (a) Explain the followings (Any Three) (9)
   i) Depth-duration-frequency curve
   ii) Conditions that must be present for the production of precipitation
   iii) Rational method to estimate the magnitude of a flood peak
   iv) Initial loss to reduce the water volume available for runoff
   v) Pan coefficient

   (b) Distinguish between the following (Any Four) (8)
   i) Depression storage and interception
   ii) Recording and non-recording rain gauges
   iii) Hydraulic and hydrologic method of flood routing
   iv) Cold and warm fronts
   v) Storm hydrograph and Direct runoff hydrograph

   (c) At a climate station, the following measurements are made: air pressure=101.1 kPa, air temperature = 35^0C, and dew point temperature = 25^0C. Calculate the corresponding vapor pressure, relative humidity, specific humidity and air density. (8)

2. (a) Explain the procedure for (i) checking the adequacy of rain gauge stations and (ii) supplementing the missing rainfall data. (10)

   (b) Seven rain gauges located within a catchment area whose shape can be approximately describe by smooth lines joining the following coordinates: (20,30), (15,45), (20,60), (40,85), (60,95), (80,95), (85,90), (75,60), (60,40) and (40,30) have the following coordinates and recorded rainfalls: (15)

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

All coordinates are expressed in Km. Compute the average rainfall in the area using Thiessen polygon method.

3. (a) Discuss the techniques of stream flow measurement? (10)

(b) A reservoir had an average area of 25 km^2. In a particular month the mean rate of inflow = 15 m^3/s, outflow = 20 m^3/s, monthly rainfall = 12 cm and increase in storage = 18 million m^3. Assuming the seepage losses to be 2.0 cm, estimate the evaporation in that month. (5)

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

Distance from of surface (m)	depth, d (m)	Immersion of current meter one end at 0.6d below water surface water Rev.	Sec
3	1.4	12	50
6	3.3	29	53
9	5.0	35	56
12	9.0	42	59
15	5.4	32	51
18	3.8	33	53
21	1.8	18	50

Calibration equation of current meter: v = 0.35N + 0.06, N = revolutions per seconds, v = velocity, m/s.

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

(b) Rainfall of magnitude 3.5 cm and 4.0 cm occurring on two consecutive 3-h durations on a catchment of area 27 km^2 produced the following hydrograph of flow at the outlet of the catchment. Estimate the rainfall excess and Φ-index. (7)

Time (h)	-6	0	6	12	18	24	30	36	42
Observed Flow (m^3/s)	6	5	13	26	21	16	12	9	7

Time (h)	48	54	60	66
Observed Flow (m^3/s)	5	5	4.5	4.5

(c) The ordinates of 4-hr UH are given below. Derive the ordinates of a 6-hr UH by the S-curve method. (12)

Time (hr)	0	4	8	12	16	20	24	28
4-hr UH ordinates (cumec)	0	23	85	152	190	158	108	65
Time (hr)	32	36	40	44				
4-hr UH ordinates (cumec)	30	15	6	0				

Section B

There are FOUR questions answer any THREE

(Assume any reasonable data if not given)

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

(b) A basin has 450 sq. km oh area, L = 40 km and L_{ca} = 15 km. Assuming C_t = 1.2 and C_p = 0.65. Develop a 3-h synthetic unit hydrograph for this basin using Snyder's method. (12)

(c) A catchment area has five rain gauge stations. In a year the annual rainfall recorded by the gauges are as follows:

Station	A	B	C	D	E
Rainfall (cm)	88	104	138	78	56

For a 10% error in the estimation of the mean rainfall, calculate the minimum number of additional stations required to be established in the catchment. (10)

6. (a) How does channel routing differ from reservoir flood routing? Define prism and Wedge storage. (7)

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

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

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

(b) The storage in the reach of a stream has been studied. The values of x and K in Muskingum equation have been identified as 0.29 and 1.60 days. If the inflow hydrograph to the reach is as given below, compute the outflow hydrograph. Assume the outflow from the reach at t=0 as 4.0 m^3/s. (15)

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

8. (a) What are the different methods to estimate the magnitude of a flood peak. Explain different methods of base flow separation. (7)

(b) The following data give flood data statistics of two rivers around Dhaka city: (18)

River	Length of records (years)	Mean annual flood (m^3/s)	σ_{n-1}
Buriganga	94	6530	2852
Shitalakya	56	5520	3368

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

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

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									

REDUCED STANDARD DEVIATION S_n IN GUMBEL'S EXTREME VALUE DISTRIBUTION

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									

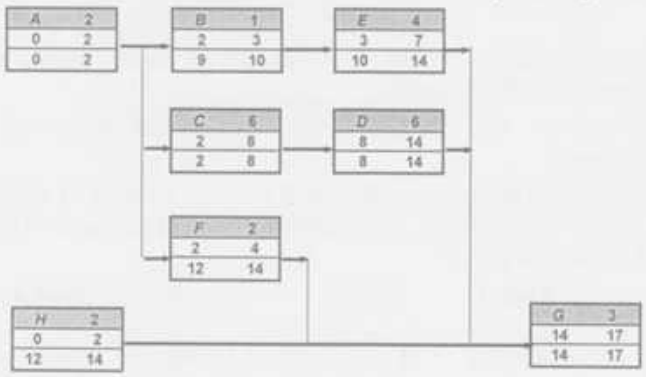
c in per cent	50	68	80	90	95	99
$f(c)$	0.674	1.00	1.282	1.645	1.96	2.58

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

Course Title: Project Planning and Management — Course Code: CE401
Time: 3 hour — Full Marks: 50

(Answer any 5 out of 6 Questions)

1(a) Why is construction safety in Bangladesh not up to the standard? 2
(b) Briefly describe the must required PPE in construction site. 2
(c) Describe 7 principles to prevent accident in construction site. 2
(d) Find the free float and total float of all the activities (A to H) from the following diagram: 4



2 Write short notes of the following: (2x5) 10
(a) Accident and Injury
(b) Risk and vulnerability
(c) Safety and Hazard
(d) Limited Tendering Method (LTM)
(e) Employee responsibility on Construction Safety

3(a) What is meant by procurement? 2
(b) Briefly describe the points to remember while purchasing/procurement. 3
(c) What are the criteria to find out the potential sources/bidders in procurement? 2
(d) Describe briefly Open Tendering Method (OTM) 3

4(a) What are differences between PERT and CPM? 2
(b) A firm has estimated the following time for its project. The company has quoted 25 days for the project to be completed. What would be the probability of success that the project will complete on time? 8

Activity	Predecessor	Optimistic Time	Most likely Time	Pessimistic Time
a	-	8	10	12
b	-	6	8	10
c	a,b	3	10	11
d	b	4	5	6
e	b	6	8	10
f	c,d	2	3	4
g	c,d	6	7	14
h	c,d,e	3	4	5

Also determine the total duration of the project and critical patch of the project.

... Continued

5(a) What do you understand by 'Time Value of Money'? 1

(b) What are major reasons that needed to be considered for 'Replacement'? 1

(c) What are the options to do with an existing asset? 1

(d) Dr. Chowdhury purchased a car 10 years back at a cost of Tk 5.10 lac whose market value is Tk 6 lac now. It can be used for 3 more years at which time its value will be Tk 3.5 lac. Operation and maintenance expenses are Tk 1.80 lac per year. Dr. Chowdhury can purchase reconditioned car with the same functionality for Tk 15 lac. In 8 years the value of this car is estimated to be Tk 8.0 lac. Operation and maintenance expenses will be Tk 36000 per year. Should Dr. Chowdhury replace the old car using before Tax MARR of 12%? 7

6(a) What are problems (at least 4) that the contractors faced during construction of Petronus Twin Tower? Briefly describe. 2

(b) Describe the uniqueness of 'Burj-Al-Arab' project in view of planning and construction management. 2

(c) A factory has a current market value of $60,000 and can be kept in service for 4 more years. With an MARR of 12%/year, when should it be abandoned? The following data are projected for future years: 6

	Year 1	Year 2	Year 3	Year 4
Net revenue	$50,000	$40,000	$15,000	$10,000
Market value	$35,000	$20,000	$15,000	$5,000

Interest Rate	12.00%								12.00%
n	F/P	P/F	A/F	A/P	F/A	P/A	A/G	P/G	n
1	1.120	0.8929	1.0000	1.1200	1.000	0.893	0.000	0.000	1
2	1.254	0.7972	0.4717	0.5917	2.120	1.690	0.472	0.797	2
3	1.405	0.7118	0.2963	0.4163	3.374	2.402	0.925	2.221	3
4	1.574	0.6355	0.2092	0.3292	4.779	3.037	1.359	4.127	4
5	1.762	0.5674	0.1574	0.2774	6.353	3.605	1.775	6.397	5
6	1.974	0.5066	0.1232	0.2432	8.115	4.111	2.172	8.930	6
7	2.211	0.4523	0.0991	0.2191	10.089	4.564	2.551	11.644	7
8	2.476	0.4039	0.0813	0.2013	12.300	4.968	2.913	14.471	8
9	2.773	0.3606	0.0677	0.1877	14.776	5.328	3.257	17.356	9
10	3.106	0.3220	0.0570	0.1770	17.549	5.650	3.585	20.254	10
11	3.479	0.2875	0.0484	0.1684	20.655	5.938	3.895	23.129	11
12	3.896	0.2567	0.0414	0.1614	24.133	6.194	4.190	25.952	12
13	4.363	0.2292	0.0357	0.1557	28.029	6.424	4.468	28.702	13
14	4.887	0.2046	0.0309	0.1509	32.393	6.628	4.732	31.362	14
15	5.474	0.1827	0.0268	0.1468	37.280	6.811	4.980	33.920	15
16	6.130	0.1631	0.0234	0.1434	42.753	6.974	5.215	36.367	16
17	6.866	0.1456	0.0205	0.1405	48.884	7.120	5.435	38.697	17
18	7.690	0.1300	0.0179	0.1379	55.750	7.250	5.643	40.908	18
19	8.613	0.1161	0.0158	0.1358	63.440	7.366	5.838	42.998	19
20	9.646	0.1037	0.0139	0.1339	72.052	7.469	6.020	44.968	20
21	10.804	0.0926	0.0122	0.1322	81.699	7.562	6.191	46.819	21
22	12.100	0.0826	0.0108	0.1308	92.503	7.645	6.351	48.554	22
23	13.552	0.0738	0.0096	0.1296	104.603	7.718	6.501	50.178	23
24	15.179	0.0659	0.0085	0.1285	118.155	7.784	6.641	51.693	24
25	17.000	0.0588	0.0075	0.1275	133.334	7.843	6.771	53.105	25
26	19.040	0.0525	0.0067	0.1267	150.334	7.896	6.892	54.418	26
27	21.325	0.0469	0.0059	0.1259	169.374	7.943	7.005	55.637	27
28	23.884	0.0419	0.0052	0.1252	190.699	7.984	7.110	56.767	28
29	26.750	0.0374	0.0047	0.1247	214.583	8.022	7.207	57.814	29
30	29.960	0.0334	0.0041	0.1241	241.333	8.055	7.297	58.782	30
31	33.555	0.0298	0.0037	0.1237	271.293	8.085	7.381	59.676	31
32	37.582	0.0266	0.0033	0.1233	304.848	8.112	7.459	60.501	32
33	42.092	0.0238	0.0029	0.1229	342.429	8.135	7.530	61.261	33
34	47.143	0.0212	0.0026	0.1226	384.521	8.157	7.596	61.961	34
35	52.800	0.0189	0.0023	0.1223	431.663	8.176	7.658	62.605	35
36	59.136	0.0169	0.0021	0.1221	484.463	8.192	7.714	63.197	36
40	93.051	0.0107	0.0013	0.1213	767.091	8.244	7.899	65.116	40
48	230.391	0.0043	0.0005	0.1205	1911.59	8.297	8.124	67.41	48
50	289.002	0.0035	0.0004	0.1204	2400.02	8.304	8.160	67.76	50
52	362.524	0.0028	0.0003	0.1203	3012.70	8.310	8.189	68.06	52
60	897.597	0.0011	0.0001	0.1201	7471.64	8.324	8.266	68.81	60
70	2787.80	0.0004	0.0000	0.1200	23223.3	8.330	8.308	69.21	70
72	3497.02	0.0003	0.0000	0.1200	29133.5	8.331	8.313	69.25	72
80	8658.48	0.0001	0.0000	0.1200	72145.7	8.332	8.324	69.36	80
84	13624.3	0.0001	0.0000	0.1200	113527.	8.333	8.327	69.39	84
90	26891.9	0.0000	0.0000	0.1200	224091.	8.333	8.330	69.41	90
96	53079.9	0.0000	0.0000	0.1200	442324.	8.333	8.332	69.43	96
100	83522.3	0.0000	0.0000	0.1200	696011.	8.333	8.332	69.43	100
inf.	inf.	0.0000	0.0000	0.1200	inf.	8.3333	8.333	69.44	inf.

Z Score Table- chart value corresponds to area below z score.

z	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.00
–3.4	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
–3.3	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005
–3.2	0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007
–3.1	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010
–3.0	0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013
–2.9	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019
–2.8	0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026
–2.7	0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035
–2.6	0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047
–2.5	0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062
–2.4	0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082
–2.3	0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107
–2.2	0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139
–2.1	0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179
–2.0	0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228
–1.9	0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287
–1.8	0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359
–1.7	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
–1.6	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
–1.5	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
–1.4	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
–1.3	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968
–1.2	0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151
–1.1	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
–1.0	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
–0.9	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
–0.8	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
–0.7	0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420
–0.6	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743
–0.5	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085
–0.4	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
–0.3	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
–0.2	0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
–0.1	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
–0.0	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000

z	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2014

Course Code: CE 403 **Full Marks: 100**
Course Title: Professional Practices and Communication **Time: 2 hour**

There are Five (5) questions. Answer any Four (4) questions (25×4=100)

1. (a)Define Communication. What are the six components of Communication? [2+3=5]
   (b)Briefly explain the importance of "Seven C's of Communication" to make written or oral communication effective. [20]
2. (a)What do you mean by Green Economy? Name three indicators of Green Economy with examples. [2+3=5]
   (b)A car consumes 7.0 liters diesel per 100 km. Calculate the carbon footprint for 1000 km of drive if the emission of carbon-di-oxide is 2.5 kg/l of diesel. [5]
   (c) Explain through equation that "steady state rate of unemployment depends on the rate of job separation and rate of job finding." [10]
   (d) Mention two problems if there is no provision of Price Adjustment in agreement. [5]

3. (a) Define "Contract". What are the essential elements of Contract? [2+3=5]
   (b) Explain briefly: Contract Risk and Responsibilities [5]
   (c) Explain two types of Two Stage Tendering Method (TSTM) [8]
   (d) What are the conditions of applicability of PAF? [2]
   (e) Contract price of reinforcement is 65,000 BDT per ton and price of that at the time of execution is TK. 72,000 and the price 28 days before receiving tenders was Tk. 69,000. What will be the adjusted price of per ton of reinforcement? Use usual values of co-efficient. [5]

4. (a) Distinguish between: [2×4=8]
   (i) Solicited and Unsolicited Proposals
   (ii) Formal and Informal Group Meeting
   (iii) High Risk and Medium-I Risk in Project
   (iv) Development Project Proposal and Development of Project Profile
   (b)What are the major activities and functions of Bangladesh Planning Commission? [8]
   (c) What is Tender Evaluation Report? What are its contents? [4]
   (d) Explain "Request for Proposal (RFP)". [5]

5. (a) Write the differences between OTM and LTM. [4]
   (b) What are the different stages of Public Procurement? [6]
   (c) What are the planning steps before a meeting? [3]
   (d) Explain different potential risks associated with Padma Bridge Project. Also discuss different measures for risk mitigation of this project. [12]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering III | Course Code: CE 411
Time: 3hrs | Full Marks: 10x10=100

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

1. For the truss shown below in *Fig. 1*, ignore the zero-force members and apply the boundary conditions to assemble the global stiffness matrix and the global load vector.

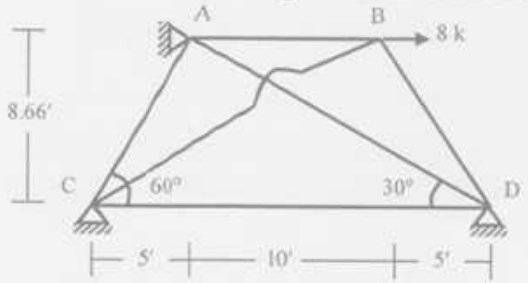


Fig. 1

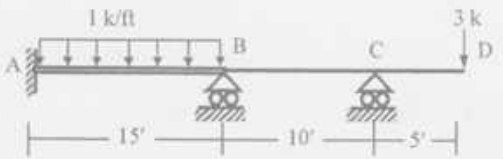


Fig. 2

2. Use Stiffness Method (neglecting axial deformations) to calculate the rotations at joint B and C of the beam shown in *Fig. 2* [Given, $EI_{AB} = 80x10^3$ k-ft^2, $EI_{BCD} = 40 x10^3$ k-ft^2].

3. For the frame shown below in *Fig. 3*, calculate unknown rotations at joint A and D considering boundary conditions and neglecting axial deformation [Given, E = 500x10^3 ksf, A = 1ft^2, I = 0.10 ft^4].

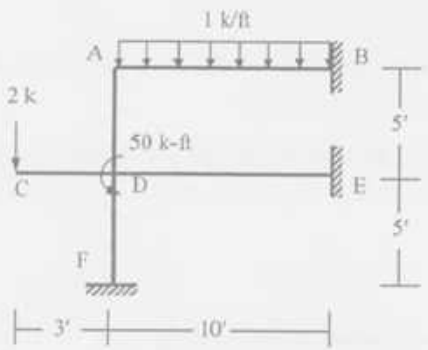


Fig. 3

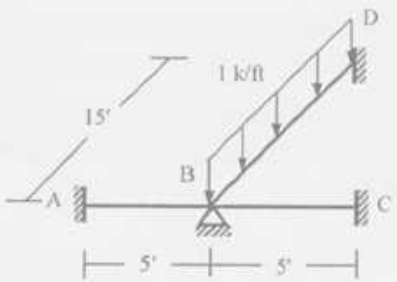
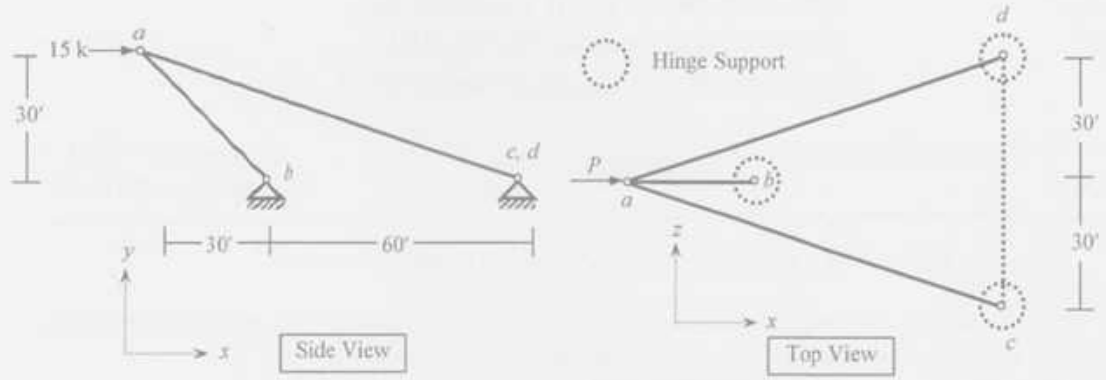


Fig. 4

4. For the grid loaded as shown in *Fig. 4*, use the stiffness method to calculate the rotations at joint B [Given, EI = 40x10^3 k-ft^2, GJ = 30x10^3 k-ft^2].

5. In the three-dimensional truss ABCD shown in *Fig. 5*, ignore zero-force members and formulate the stiffness matrix, load vector and write down the boundary conditions [Given, EA/L = constant = 500 k/ft].



Nodal Coordinates: a (-30, 30, 0), b (0, 0, 0), c (60, 0, -30), d (60, 0, 30)

Fig. 5

6. Use Stiffness Method to calculate the approximate first critical buckling load P for the beam ABC loaded as shown below in *Fig. 6*, considering flexural deformations only with geometric nonlinearity [Given, EI = 50×10^3 k-ft^2].

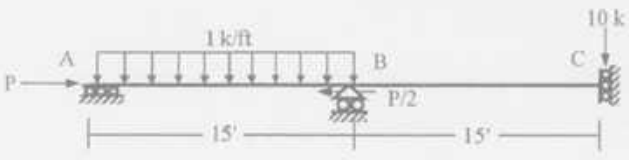


Fig. 6

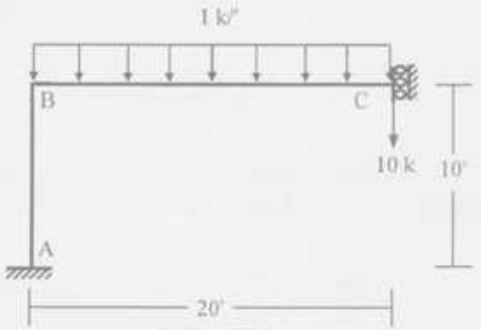


Fig. 7

7. Use the Stiffness Method (considering geometric nonlinearity) to calculate the joint deflections and rotations of the frame loaded as shown in *Fig. 7* [Given, EI = 40×10^3 k-ft^2].

8. Use the Energy Method to calculate the plastic moment M_p needed to prevent the development of plastic hinge mechanism in the beam ABCD loaded as shown in *Fig. 8* [Given, $M_{p(AB)} = M_{p(BC)} = M_p$, $M_{p(CD)} = 2M_p$].

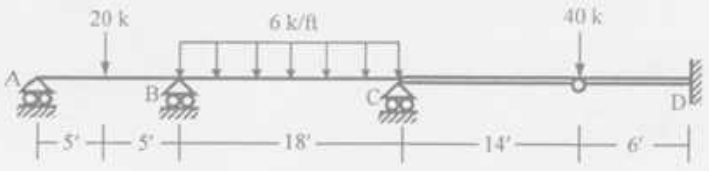
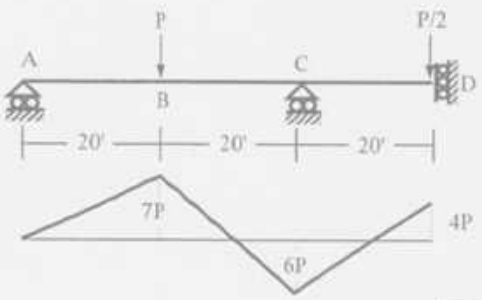
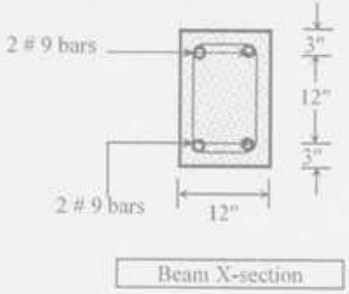


Fig. 8

9. Use bending moment diagram to calculate the force P needed to develop plastic hinge mechanism in the reinforced concrete beam ABCD loaded as shown in *Fig. 9* [Given, $f_c' = 4$ ksi, $f_y = 60$ ksi].





Beam X-section

Fig. 9

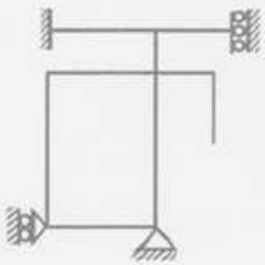
10. For the plane truss shown in *Fig. 1*, calculate its natural frequencies using consistent mass matrices and applying boundary conditions [Given, E = 30000 ksi, A = 2 in^2, m = 1.5×10^{-6} k-sec^2/in^2].

11. For the beam shown in *Fig. 6*, calculate the approximate first natural frequency in transverse direction using consistent mass matrices [Given, EI = $40X10^3$ k-ft^2, m = 0.0045 k-sec^2/ft^2].

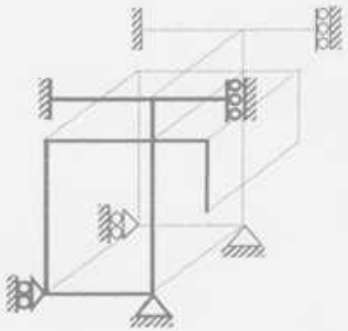
12. For the beam loaded as shown in *Fig.10*, use the Stiffness Method to calculate the rotation at joint B and vertical displacement of joint C, if C is supported by a circular foundation of radius 3-ft on sub-soil (half-space) [Given, Unit weight of soil = 0.12 k/ft^2, shear wave velocity (v_s) = 1000 ft/sec, Poisson's ratio =0.25, EI = 40×10^3 k-ft^2].

Fig. 10

13. Determine the size of the stiffness matrices (with and without considering boundary conditions) of the 2D frame and 3D frame shown in *Fig. 11*. Also determine the size of the stiffness matrices if axial deformations are neglected.



2D Frame



3D Frame

Fig. 11

14. Briefly explain why

i. a truss member hinged at both ends is a zero-force member
ii. axial deformations are sometimes neglected for the structural analysis of frames but not trusses
iii. stiffness matrix of a 3D truss member is (6 × 6) while that of a 3D frame member is (12 × 12)
iv. the effect of foundation flexibility on the structural response to seismic vibration can be harmful or beneficial
v. the stiffness matrix and geometric stiffness matrix of a structure are both symmetric (use equations with shape function ψ)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

Course No: CE 415 **Course Title: Structural Engineering V**
Time: 2.0 hours **Full Marks: 100**

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

1. (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 75 kN-m. Assume a trial depth of the section is $42\sqrt{(M_T)}$ in mm (where M_T is in kN-m) . The effective prestress for steel is 850 MPa, and allowable stress for concrete under working load is -11 MPa. (8)

   (b) Make final design for the preliminary section obtained in 1(a) based on elastic theory and allowing tension in the concrete both at transfer and under working load. [Given values are f'_{ci}=35 MPa, f'_b = 1.65MPa, f_b = -12.5 MPa, f_0 = 1035 MPa, F_o= 968 kN]. (17)

2. (a) A simply supported concrete beam of 13 m span post tensioned with 860 mm^2 of high-tensile steel to an initial prestress of 1000 MPa. A concentrated load of 45 kN is applied at midspan immediately after prestressing. If E_c= 36000 MPa compute the initial deflection at midspan due to prestress and the beam's own weight. Cross section of the rectangular beam is of 300 mm width 500 mm depth. The c.g. of cable is 150 mm from bottom at midspan and 300 mm from top at end of section. Also estimate the deflection after 2.5 months assuming creep factor of 1.75. [Given that 20% loss of prestress occurs]. (15)

   (b) Draw four layouts of tendons in simple post-tensioned beam. (5)

   (c) Draw the load deflection curve of a prestressed beam. (5)

3. A section of simply supported composite beam of 25m span is shown in **Figure 1.** The precast stem is prestressed with an effective force of 1200 kN assuming a total loss as 15%. After this precast portion is erected in place, a top slab of 120mm by 1000 mm wide is cast in place and it produces a moment of 140 kN-m. After the slab has hardened the composite section is to carry a uniformly distributed live load moment of 650 kN-m. Moment at midspan due to weight of the precast section is 120 kN-m. Compute the stresses in the section at different stage of loading and also draw the stress distribution at these stages. [Given, A_{ps}= 2200 mm^2, f_{pu}=1340 MPa, f'_c= 35 MPa]. (25)

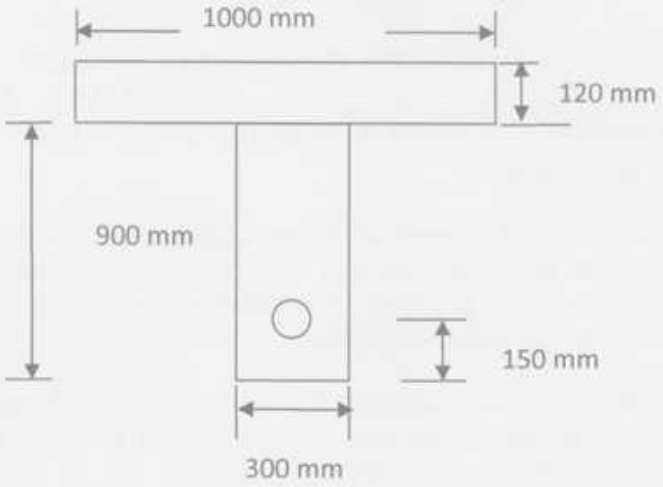


Figure: 1

4. (a) Check shear strength for station 2-2 for the beam in **Figure 2**. The symmetric I-shaped noncomposite section spans 20m and it is adequate for w_u = 75 kN/m. Given, F = 1860 kN, f'_c = 50 MPa and w_d = 6 kN/m (beam weight),e = 340mm. (15)

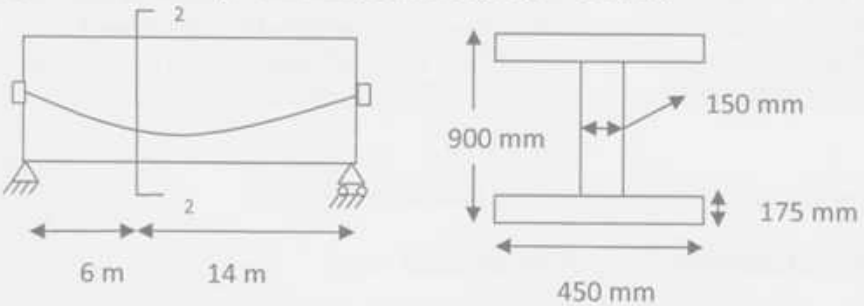


Figure: 2

(b) Define length of transfer. Write down the most important factors which affect the length of transfer. (10)

5. (a) Draw the typical layouts for double cantilevers. What are the differences between pre-tensioning and Post-tensioning? (4+6)

(b) Twelve steel wires of 9 mm diameter with anchorages are used for prestressing of a 15m pretensioned beam. The beam has symmetrical I-section shown in **Figure 2.** (15)
[Given, f_o=860MPa, f_{se}= 750 MPa f'_c= 40 MPa, M_G= 75 kN-m, M_T=270 kN-m at midspan].
Determine the position for the c.g.s. line.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
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. Two ¾-in.thick A36 steel plates are lap connected using five ⅞-in. diameter A325 bolts in standard holes as shown in Fig. 1. Determine the design strength of the splice in block shear using AISC/LRFD method. Given: U = 1. See Annexure-1. [8 ⅓]

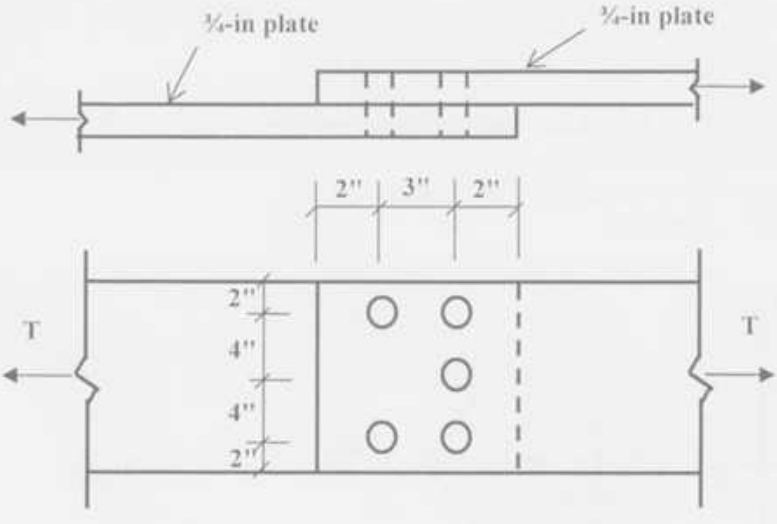


Fig. 1

2. Compute the yield moment and plastic moment capacities and shape factor for major axis bending of the section shown in Fig. 2. Given F_y = 42 ksi. [8 ⅓]

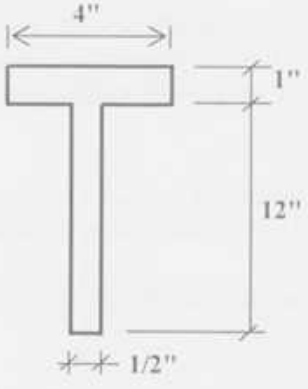


Fig. 2

3. Using AISC/ASD method, determine the axial load capacity, P of the W12×40, A36 steel column section with support conditions for X and Y axis buckling as shown in Fig. 3. 8 ⅓
Given: For W12×40 section, area A = 11.8 in^2, radius of gyration about strong axis, X and weak axis, Y are r_x = 5.13 in. and r_y = 1.93 in. respectively; E = 29000 ksi. See Annexure-2.

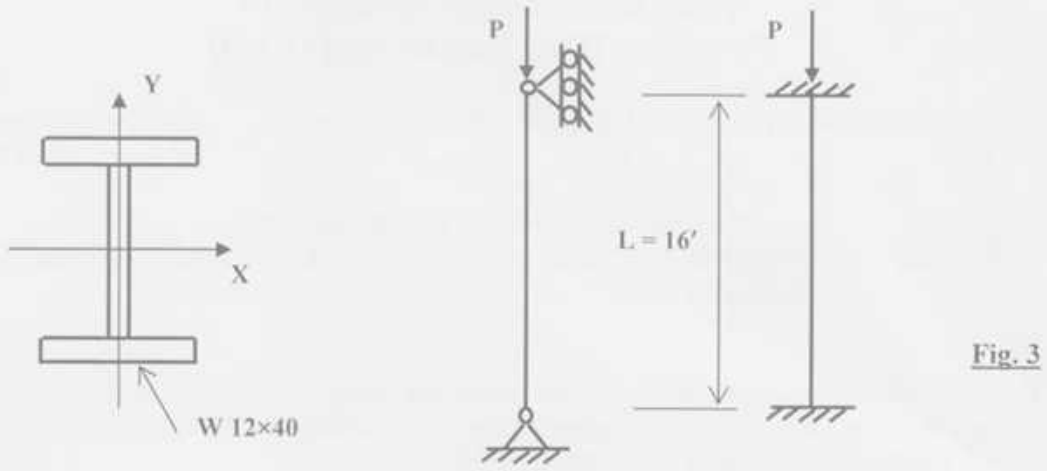


Fig. 3

4. The webless H section shown in Fig. 4 has the residual stress distribution as shown in the figure. Determine the corresponding values of L/r_x and L/r_y, if a column with the given section buckles at an imposed uniform compressive strain of –0.0012 in/in. 8 ⅓
Given: F_y = 36 ksi and E = 30000 ksi.

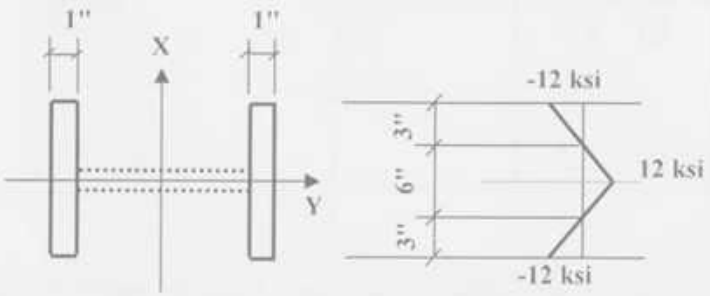


Fig. 4

5. Calculate the design strength of a W24×62 building column by AISC/LRFD method. The column is of A36 steel, 15 ft long with cross sectional area, A= 18.2 in^2. Radius of gyration about X and Y axes are r_x = 9.23 in. and r_y = 1.38 in. respectively. Assume K=1 for both X and Y axes. 8 ⅓
Given: E = 29000 ksi. See Annexure-3.

6. Determine, the maximum uniformly distributed load that may be safely carried by a beam on a 32-ft simply supported span, if it has a wide flange section W24×68 with section modulus S_x = 154 in^3. 8 ⅓
Assume that compact section requirements will be satisfied and hence, design the spacing of lateral bracings.
Also check whether the deflection criterion is satisfied or not.
Given: F_y = 36 ksi; For beam section W24×68, d = 23.73 inch, b_f = 8.965 inch and d/A_f = 4.52.
Annexure-4 is provided to facilitate the design.

7. The residual stress for a 12×1-in. plate to be used as a tension member is shown in Fig. 5. Determine the equation for the stress-strain behaviour in tension of the plate at an imposed tensile strain of 0.0014. What will be the tangent modulus E_t at this strain? Given $F_y = 42$ ksi; $E = 30000$ ksi. | 8 ⅓

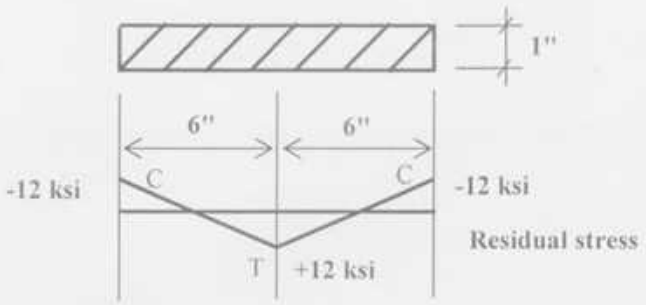


Fig. 5

8. Determine the effective length coefficients for the columns BC, EF, CD and FG of the frame shown in Fig. 6. The relevant moments of inertia of the members in inch^4 are shown in the figure. The Nomographs are provided in Annexure-5. Given: The multiplication factors for stiffnesses for a beam with far end fixed are 2/3 (with sidesway) and 2 (without sidesway). | 8 ⅓

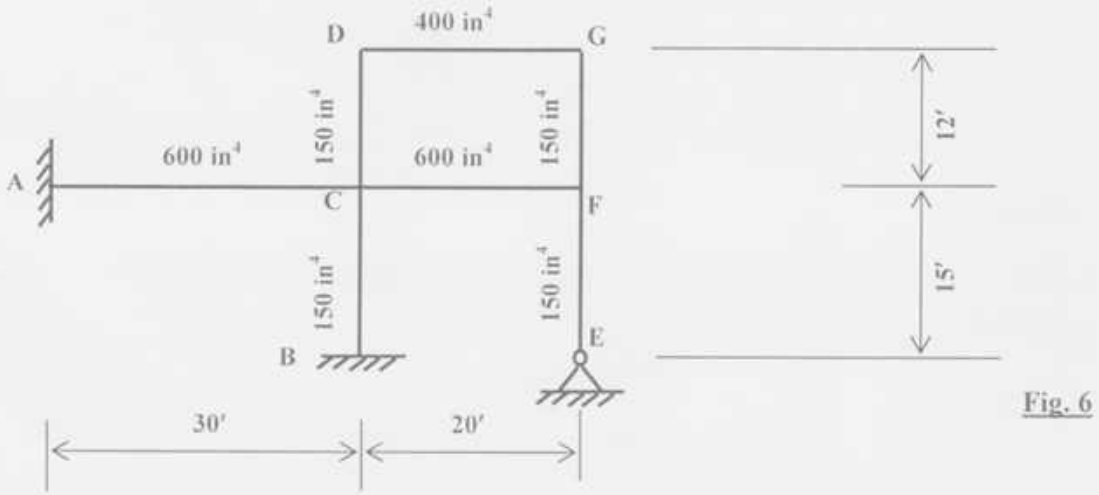


Fig. 6

ANNEXURE-1

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

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

ANNEXURE-2

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

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

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

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

ANNEXURE-3

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

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

in which

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

ANNEXURE-4

Specification Formulas

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

Compact section: $$F_b = 0.66F_y \tag{5-16a}$$

Noncompact section: $$F_b = 0.60F_y \tag{5-16b}$$

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

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

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

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

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

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:

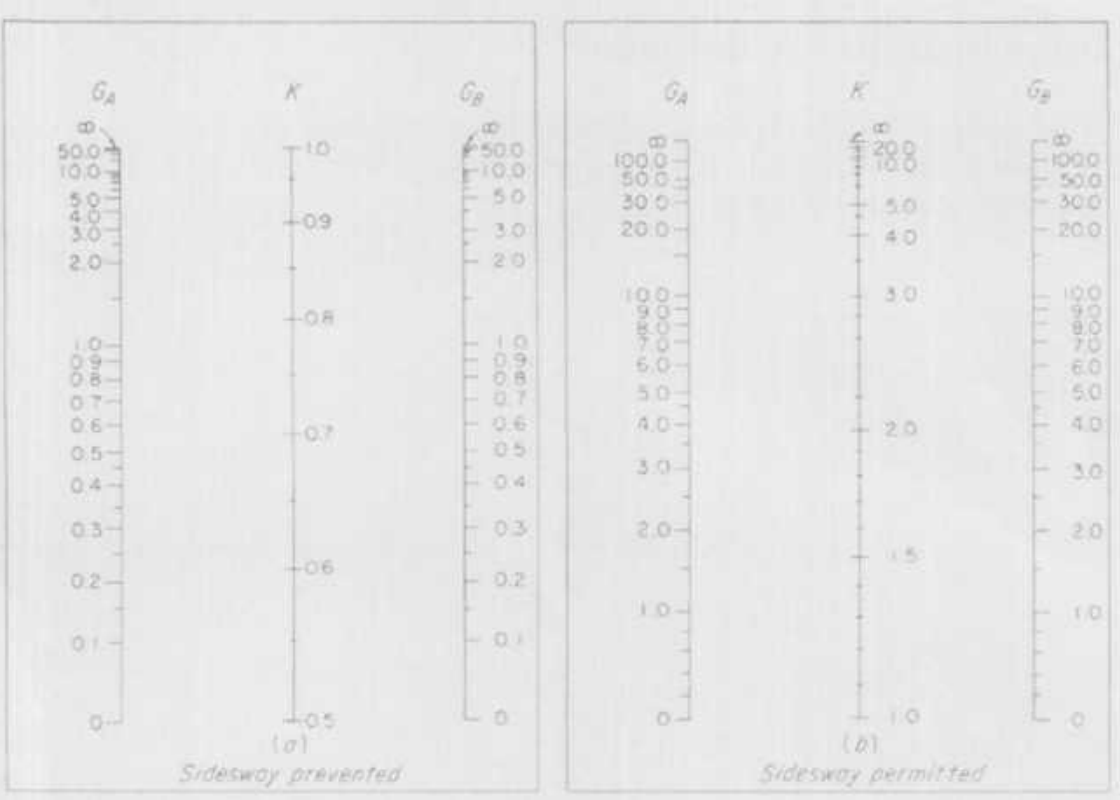
$$L_c = \frac{76b_f}{\sqrt{F_y}} \tag{5-17a}$$

$$L_c = \frac{20{,}000}{F_y d/A_f} \tag{5-17b}$$

DESIGN FOR LIMITED DEFLECTION

$$\frac{L}{d} = \frac{480}{F_b} \tag{5-13}$$

ANNEXURE-5



Nomograph for effective length of columns.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering IX (Earthquake Resistant Design and Retrofitting) — Course Code: CE 423

Time: 2 Hours — Full Marks: 100

There are 7 (Seven) questions. Answer any 5 (Five)

1. **a.** State D'Alembert's Principle. **(5)**

   b. A free vibration test is conducted on an empty elevated water tank. A cable attached to the tank applies a lateral force of 16.4 kips and pulls the tank horizontally by 2 in. The cable is suddenly cut and the resulting free vibration is recorded. At the end of four complete cycles, the time is 2.0 sec, the displacement amplitude is 1 in. [Given : damping ratio= 2.76% after four cycles] **(15)**

   From these data compute the following:

   (i) Natural period of undamped vibration
   (ii) Stiffness
   (iii) Weight
   (iv) Damping coefficient
   (v) Number of cycles required for the displacement amplitude to decrease to 0.2 in.

2. **a.** What is seismic base isolation system? What are the characteristics of a well-designed seismic base isolation system? **(10)**

   b. Write short notes on: (i) Elastomeric bearings, (ii) Spherical sliding bearing. **(10)**

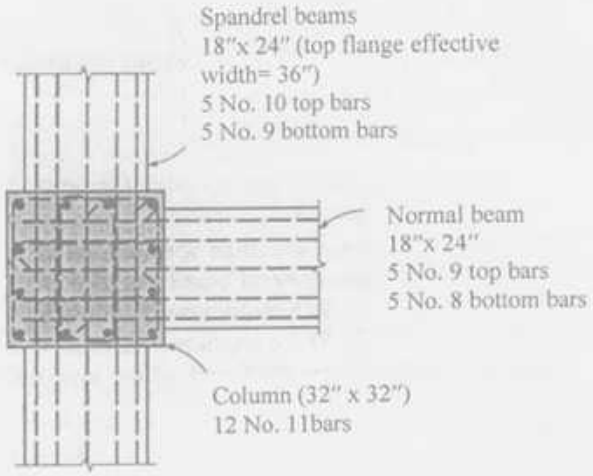
3. **a.** Define undamped, critically damped, and overdamped systems. **(3)**

   b. The exterior joint shown in the figure below is a part of a reinforced concrete frame designed to resist earthquake loads. A 6 in slab, not shown, is reinforced with No. 5 bars spaced 10 in center-to-center at the same level as the flexural steel in the beams. **(17)**

   The member section dimensions and reinforcement are as shown. The frame story height is 12 ft. Material strengths are f'_c =4000 psi and f_y =60000 psi.

   The maximum factored axial load on the upper column framing into the joint is 2000 kips, and the maximum factored axial load on the lower column is 2200 kips.

   Check if the joint satisfies weak beam-strong column design as per ACI 318.



4. a. Write short notes on: (i) Anchorage, (ii) Development length. (8)

b. For the same column in Question 3, determine the minimum transverse reinforcement required over length l_o. Show the reinforcement detailing in neat sketch. (12)

5. a. Explain how degree of confinement effects the nominal shear capacity of beam-column joints. (5)

b. 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. (15)

The clear span of the beam is 24 ft and the c/c spacing of the beam 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/ft and LL = 1.2 kip/ft. Also draw a cross-section of the beam.

Given f'_c = 4000 psi and f_y = 60000 psi.

6. a. What information should a professional engineer collect before retrofitting a RC structure? (6)

b. Write short notes on: (i) FRP, (ii) Strengthening limit. (8)

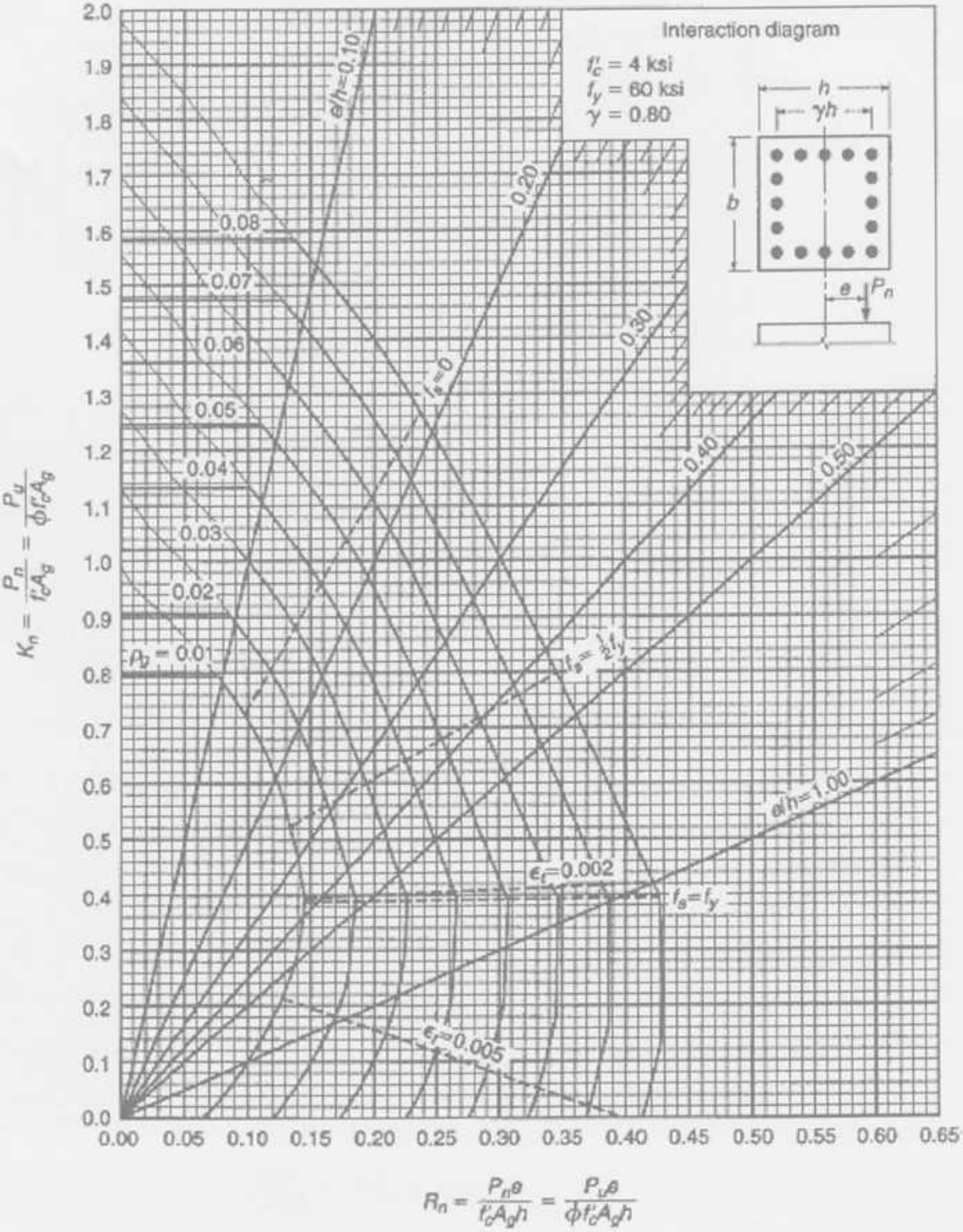
c. What are the failure modes of FRP strengthened flexural member as per ACI. (6)

7. a. Why unreinforced masonry (URM) structures are vulnerable to earthquake? What steps should an engineer take to avoid failure of URM structures due to earthquake? (8)

b. Write short notes on: (i) Masonry band, (ii) Masonry materials. (6)

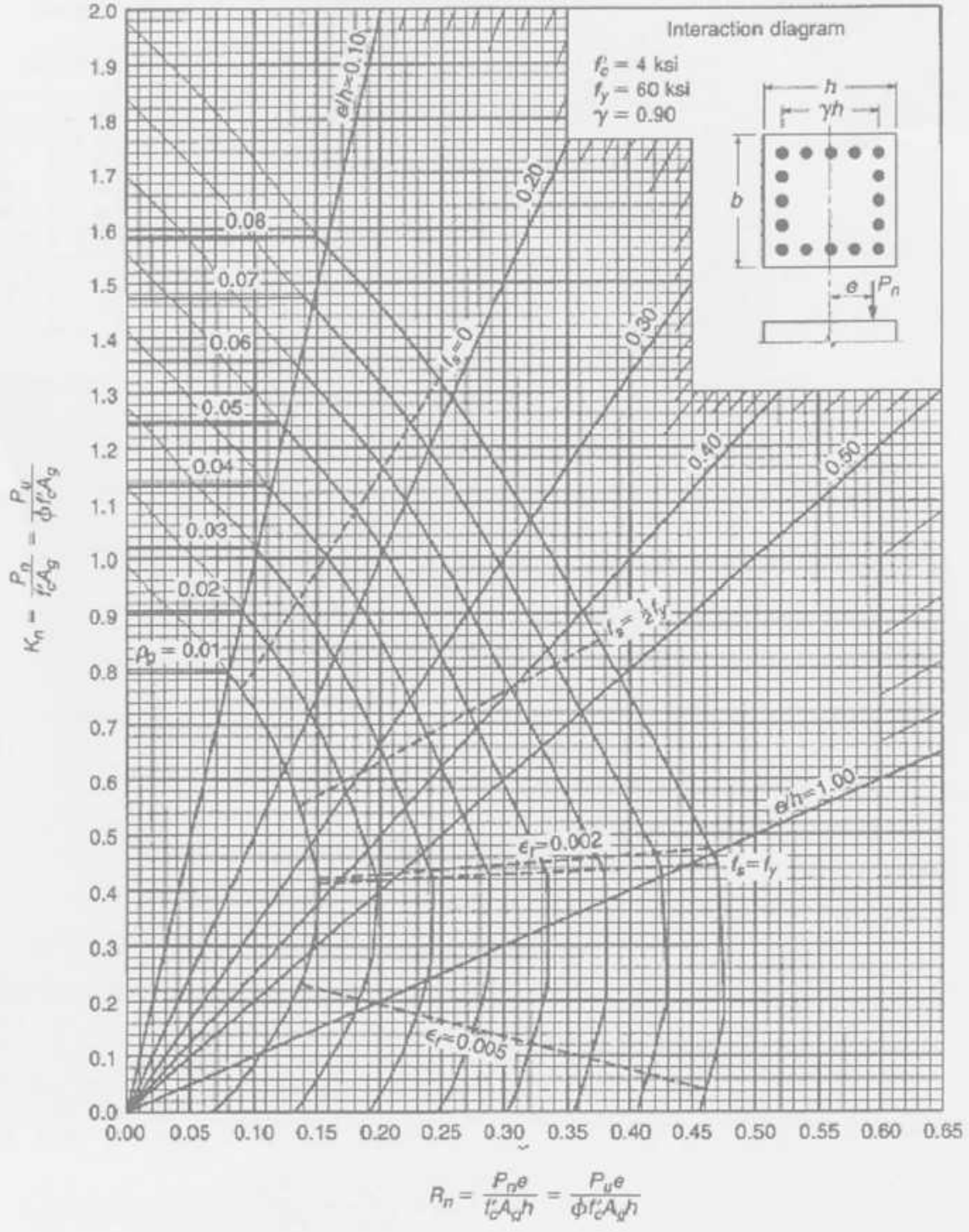
c. Due to change in the seismic mapping of Bangladesh according to BNBC, suppose UAP-CE building becomes deficient to new seismic requirement. To make it earthquake resistant, 30% of original construction cost is required. (6)

In your judgment, is it more feasible to retrofit the structure or demolish it and build a new one? Justify your answer.



$$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$$

$$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$$


Interaction diagram
f'_c = 4 ksi
f_y = 60 ksi
γ = 0.90
h
γh
b
e
P_n
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$
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
$f_s = \frac{1}{2} f_y$
$f_s = f_y$
ϵ_t=0.002
ϵ_t=0.005
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2014

Course Code: CE 431 **Full Marks: 100**
Course Title: Environmental Engineering III (Solid Waste Management) **Time: 2 hours**
Level -4, Term -2 (Section – B)

There are five (5) questions. Answer any **four (4)** questions (25×4=100)

1. (a) What is a sanitary landfill? What are its advantages and disadvantages? **[2+6=8]**

   (b) Explain IPCC method to estimate the landfill gas generation. **[5]**

   (c) Estimate the theoretical volume of methane (CH_4), carbon-di-oxide (CO_2) and Ammonia (NH_3) that would be expected from anaerobic digestion of per ton of waste having the composition $C_{40}H_{100}O_{30}N$. The density of CH4, CO_2 and NH_3 at standard temperature and pressure (STP) are 0.7167 kg/m^3, 1.9783 kg/m^3 and 0.696 kg/m^3 respectively.(a) What are the most important properties to be known if the solid wastes are to be used as fuel? **[12]**

2. (a) Draw a typical layout plan of a Landfill site. **[10]**

   (b) Determine the break-even time for a stationary container system with a separate transfer and transport system for transporting wastes collected from a municipal area to a landfill site. Assume the following data while calculating: **[15]**

   - Transportation cost:
     Stationary container system using a 18 m^3 compactor: BDT 2000/ hr
     Tractor-trailer transport unit with a capacity of 120 m^3: BDT 2500/ hr
   - Other costs:
     Transfer station operating cost: BDT 40/m^3
     Extra cost for unloading facilities: BDT 5/m^3
   - Other data:
     Density of wastes in compactor = 350 kg/ m^3
     Density of wastes in transport unit = 160 kg/ m^3

3. (a) Define Hazardous Waste? What are the general categories of hazardous waste? What are the factors to be considered for designing landfills for hazardous waste? **[2+3+3=8]**

   (b) Draw a diagram showing different pathways of human exposure to hazardous waste. **[5]**

(c) The following five soil layers are lying between the base of a landfill and the underlying aquifer. How long will it take for leachates to migrate to the aquifer? Also calculate the amount of leachate that will flow down if the landfill area is 60 hectares. Comment whether the site is appropriate for a landfill or not. **[12]**

Layers of soil	Depth (m)	Porosity (%)	Permeability (m/s)
Layer A	2.5	40	2.5×10^{-8}
Layer B	1.5	45	1.9×10^{-7}
Layer C	1.8	42	5.3×10^{-7}
Layer D	2.8	39	3.8×10^{-5}
Layer E	3.0	41	4.1×10^{-8}

4. (a) What is leachate? Explain the characteristics of leachate. What are the key components of leachate management system? **[2+5+3=10]**

(b) Calculate the required landfill area for a community for the year 2015 from the following data: **[10]**

Projected Population = 15,00,000
Per capital generation rate = 0.55 kg/cap/day
Diversion Factor = 0.20
Compacted waste density = 700 kg/m^3
Average depth of landfilling = 7.5 m
Assume a daily soil cover is used that accounts for 20% of the landfill volume.

(c) Write five standards/guidelines for the Deep Burial of Hospital Wastes. **[5]**

5. (a) Distinguish between Resource Recovery by Material Separation and Resource Recovery by Material Conversion. **[4]**

(b) Briefly describe the stages of recycling process of solid wastes in Bangladesh. **[6]**

(c) Provide a schematic of the necessary stages in anaerobic digestion process and state the general formula for anaerobic transformation. **[10]**

(d) For a stationary container system, 12 numbers of containers are emptied per trip, each having a volume of 3.5 m^3. The container utilization factor and collection vehicle compaction ratio are 0.8 and 2.75 respectively. Determine the approximate truck capacity. **[5]**

Given formula:

$$C_aH_bO_cN_d + \frac{4a-b-2c+3d}{4}H_2O \rightarrow \frac{4a+b-2c-3d}{8}CH_4 + \frac{4a-b+2c+3d}{8}CO_2 + d\,NH_3$$

Haul Container System	Stationary Container System
$P_{hcs} = pc + uc + dbc$ $T_{hcs} = P_{hcs} + s + a + bx$ $N_d = \frac{[(1-W)H - (t_1 + t_2)]}{P_{hcs} + s + a + bx}$	$T_{scs} = P_{scs} + s + a + bx$ $P_{scs} = C_t uc + (n_p - 1)dbc$ $C_t = vr/cf$ $N_d = V_d/vr$ $H = \frac{(t_1 + t_2) + N_d(P_{scs} + s + a + bx)}{1 - W}$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

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

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

1. (a) Discuss the different stages of landfill gas generation. (8)

   (b) Explain closure and post-closure maintenance of landfill. (5)

   (c) Suppose "as delivered" MSW discards include 67.3 percent decomposable materials such as paper, yard trimmings, food waste and wood. Of that 32.3 percent is moisture. An elemental analysis of the dried decomposable components yields the following mass percentages: (12)

Element	C	H	O	N	Other	Total
Dry mass (%)	44.17	5.91	42.50	0.73	6.69	100%

   Find the chemical formula for the C, H, O, N portion of the decomposable. Also find the energy content of the methane that would be generated per kg of discards. The HHV (high heating value) of methane is 890 kj/mol.

2. (a) Define solid waste. Describes the diagram of recycling and resources recovery system in urban centers. (2+8)

   What are the objectives of an effective solid waste management system ? (3)

   (b) Write explanatory notes on the following :(Any two= 2x3) (6)

   i) Transfer station, ii) Final cover of landfill, and iii) Street cleansing

   (c) Write down the advantages of source reduction and on-site processing of solid waste management. (6)

3. (a) Define anaerobic digestion. Write down the advantages of anaerobic digestion. (2+5)

   (b) Given that 3000 kg/h of municipal solid waste with 15 percent 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 300 kg/h, determine the recovery efficiency and (8)

effectiveness of the screen.

Or

A recent study on recycling at the Los Angeles International Airport (LAX) generates about 19,000 tons of solid waste per year (1.3 pounds per passenger). On the annual basis , LAX recycles 12 tons of aluminum; 2,021 tons of cardboard ; 527 tons of office paper, 89 tons of newspaper, 17 tons of glass and 921 tons of plastic. In addition, they compost 271 tons of food waste.

i. Find the equivalent greenhouse gas savings associated with these recycled and composted materials assuming they would have all gone to a landfill if they hadn't been recycled.

ii. If the landfill charges \$80/ton (called the tipping fee), how much money is saved in tipping fees by recycling and composting ?

iii. If, in the future, there is a carbon tax \$10 per metric ton of carbon dioxide, how much would LAX save in carbon taxes at the current recycling rate ?

(c) How do the migration of landfill gas can be controlled ? (5)

(d) What strategies should be followed to minimize the amount of leachate in landfill ? (5)

4. (a) What are the objectives of thermal treatment process ? Write down the benefits and drawbacks of incineration. (3+5)

(b) Determine the break-even time for a stationary- container system and a separate transfer & transport system for transporting wastes collected from a metropolitan area to a landfill disposal site. Assume the following cost and system data are applicable. (10)

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

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

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

(c) Estimation of the amount of gas produced from the organic fraction of MSW under anaerobic conditions. Estimate the total theoretical amount of gas that could be produced under anaerobic conditions in a sanitary landfill per unit weight of solid wastes given that the chemical formula of the typical waste are as follows: (7)

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

Given that the total weight of the organic material in 100 lb of solid waste is equal to 75

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

(b) Estimate the landfill area needed to handle one year's MSW for a town of 100,000 people. Assume per capita national average discards of 3 lbs per day, no combustion, a landfill density of 1,000 lb/yd^3 and one 10-foot lift per year. Assume 25 % of the cell volume is soil used for cover. (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 $= \frac{W_1 f_1}{W_2 f_2}\{1 - \frac{W_1(1-f_1)}{W_2(1-f_2)}\}$

TABLE 9.8

Net Greenhouse Gas Emission Reductions Compared to Landfilling for Source Reduction, Recycling, Composting, or Combustion in Metric Tons of Carbon Equivalents Per Ton of Material (MTCE/ton)

Materials	Source Reduction		Recycling or Composting versus Landfilling	Combustion versus Landfilling
	Current Mix of Inputs	100% Virgin Inputs		
Aluminum cans	2.28	4.28	3.71	−0.01
Corrugated cardboard	1.63	2.32	0.96	0.29
Fly ash	0.01	0.01	0.25	0.01
Food waste composted	NA	NA	0.25	0.25
Glass	0.88	1.02	0.50	0.43
HDPE	0.50	0.55	0.39	−0.24
Magazines	2.28	2.36	0.76	0.05
Mixed metals	NA	NA	1.44	0.30
Mixed MSW	NA	NA	NA	0.15
Mixed paper	NA	NA	1.06	0.27
Mixed plastics	NA	NA	0.42	−0.26
Mixed recyclables	NA	NA	0.83	0.20
Newspapers	1.09	1.39	0.52	−0.03
Office paper	2.71	2.79	1.31	0.70
Personal computers	15.14	15.14	0.63	0.06
PET	0.58	0.60	0.43	−0.28
Steel cans	0.88	1.02	0.50	0.43
Textbooks	3.03	3.11	1.38	0.70
Tires	1.10	1.10	0.51	−0.04
Yard trimmings	NA	NA	−0.01	0.00

Source: U.S. EPA. 2006b.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering IV — Course Code: CE 433
Time: 2 hour — Full marks: 100 (=4×25)

[ANSWER ALL PARTS (i.e. a, b) OF EACH QUESTION TOGETHER]

(Note: Assume reasonable value for any missing data)

Answer any FOUR questions out of FIVE.

1. (a) Define with examples: (i) Persistent organic pollutants and (ii) Persistent inorganic pollutants. Also mention their adverse effects. (8)

   River water quality becomes worse during summer due to temperature rise. Explain the reasons. (5)

   (b) A city discharges 10,000 m^3/d of sewage into a stream whose minimum rate of flow is 7.5 m^3/s. The velocity of stream is 2.3 km/h. The temperature of the sewage is 20°C and that of the water stream is 15°C. The 20°C BOD_5 of the sewage is 190 mg/l and that of the stream water is 1 mg/l. The sewage contains no DO while the stream is 90% saturated with dissolved oxygen. The values of K_d and K_r at 20°C are 0.25/d and 0.65/d respectively. Use the temperature coefficient of 1.047 for K_d and 1.024 for K_r. Determine: (12)
   (i) The critical oxygen deficit, critical (minimum) DO and its location.
   (ii) Sketch the DO profile for a 100-km reach of the stream below the discharge. Attach the graph paper with your answer script.

2. (a) Find out the probable water quality problems, affected water uses and associated water quality variables for the following manifestation of problems in/near a stream: (12)
   (i) Significant fish kill (ii) Disease transmission
   (iii) Excessive algae growth (iv) Ecosystem upset

   (b) What kind of BOD would you expect to measure from a 5-day BOD test? CBOD or NBOD? Explain your answer with relevant figure. (5)

   What is seeding? Why is it done during BOD test? (2)

   30 mL wastewater is mixed with dilution water to fill 300 mL BOD bottle. The drop of DO after 5 days is 4.8 mg/L. For a BOD bottle filled with only dilution water, DO drop is 1.2 mg/L after 5 days. If $k = 0.21\ d^{-1}$ at 20°C, determine – (i) Ultimate CBOD, (ii) BOD_5 at 25°C and (iii) BOD remaining after 10 days at 25°C. (6)

3. (a) Define temperature inversion. Briefly explain the types of temperature inversions. (5)

A stack emitting 50 g/s of NO_2 has an effective stack height of 150m. The wind speed is 4m/s at 10m, and it is a clear summer day with the sun nearly overhead. Estimate the ground level NO_2 concentration – (9)
(a) directly downwind at a distance of 3 km
(b) at a point downwind where NO_2 is maximum
(c) at a point located 3 km downwind and 0.5 km of cross- downwind axis

(b) Explain why particulates of anthropogenic origin are considered more harmful compared to those from natural origin? (4)

Explain the effects of air-fuel ratio on air pollution with relevant figure. (7)

4. (a) A power plant has a 150 m stack with inside radius of 1m. The exhaust gases leave the stack with an exhaust velocity of 15 m/s at a temperature of 200°C. Ambient temperature is 6°C. Wind speed at effective stack height is estimated to be 5 m/s, surface wind speed is 3m/s and it is a cloudy summer day. Estimate the effective stack height. (7)

If the stack height remains below the inversion layer where super-adiabatic lapse rate exists, draw the plume dispersion pattern. Also explain the pollution potential near to ground surface from this dispersion pattern. (5)

(b) Describe the vehicular pollution control measures. (6)

Briefly explain the formation of NO_x during fossil fuel combustion. (3)

Mention the sources of NO_x. (4)

5. (a) What is eutrophication? Briefly explain the classification of lakes from the viewpoint of eutrophication. (5)

Briefly describe the layers in a stratified lake with necessary figure. (5)

Which type of lake becomes more vulnerable to summer stratification? Explain your answer with relevant figure. (5)

(b) A lake of 100×10^5 m^2 area is being fed by a stream flow of 15 m^3/s. Phosphorus (P) concentration in the stream water is 0.0003 g/m^3. The lake also receives a wastewater flow of 0.4 m^3/s, which contain 10.0 mg/l (= 10.0 g/m^3) of phosphorus. P settling rate is given by 10 m/yr (= 3.17×10^{-7} m/s). (10)
(i) Estimate average P concentration in the lake.
(ii) Estimate P removal rate at a treatment plant to keep P concentration below 0.05 mg/L.

Formulae:

$$\bar{u}(z) = \overline{u_0}\left(\frac{z}{z_0}\right)^{\rho}$$

$F = gr^2 v_s (1 - T_a/T_s)$

$$\Delta h = \frac{1.6F^{1/3}x_f^{2/3}}{u}$$

$x_f = 120\ F^{0.4}$ if $F \geq 55\ m^4/s^3$

$x_f = 50\ F^{5/8}$ if $F < 55\ m^4/s^3$

$BOD_t = L_0 (1 - e^{-kt})$

$$P = \frac{S}{Q + v_s \cdot A}$$

$$D = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t} - e^{-k_r t}\right) + D_0 e^{-k_r t}$$

$$k_r = \frac{3.9u^{1/2}}{H^{3/2}} \qquad t_c = \frac{1}{k_r - k_d}\ln\left[\frac{k_r}{k_d}\left(1 - \frac{D_0[k_r - k_d]}{k_d \cdot L_0}\right)\right]$$

$$D_{\max} = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t_c} - e^{-k_r t_c}\right) + D_0 e^{-k_r t_c}$$

$DO_{(sat)} = 14.62 - 0.39\ T + 0.007714\ T^2 - 0.0000646\ T^3$

$$C(x,y,z) = \frac{Q}{2\pi u \sigma_y \sigma_z} \times \exp\left(\frac{-y^2}{2\sigma_y^2}\right)\left[\exp\left(-\frac{(z-H)^2}{2\sigma_z^2}\right) + \exp\left(-\frac{(z+H)^2}{2\sigma_z^2}\right)\right]$$

$$C_{\max} = \frac{Q}{u} \times \frac{C_u}{Q_{\max}}$$

Surface wind speed[a] (m/s)	Day solar insolation			Night cloudiness[e]	
	Strong[b]	Moderate[c]	Slight[d]	Cloudy ($\geq$ 4/8)	Clear ($\leq$ 3/8)
< 2	A	A–B[f]	B	E	F
2–3	A–B	B	C	E	F
3–5	B	B–C	C	D	E
5–6	C	C–D	D	D	D
> 6	C	D	D	D	D

[a]Surface wind speed is measured at 10 m above the ground.
[b]Corresponds to clear summer day with sun higher than 60° above the horizon.
[c]Corresponds to a summer day with a few broken clouds, of a clear day with sun 35–60° above the horizon.
[d]Corresponds to a fall afternoon, or a cloudy summer day, or clear summer day with the sun 15–35° above the horizon.
[e]Cloudiness is defined as the fraction of sky covered my clouds.
[f]For A–B, B–C, or C–D conditions, average the values obtained for each.
Note: A, Very unstable; B, moderately unstable; C, slightly unstable; D, neutral; E, slightly stable; F, stable. Regardless of windspeed, class D should be assumed for overcast conditions, day or night.
Source: Turner (1970).

TABLE 7.7 WIND PROFILE EXPONENT p FOR ROUGH TERRAIN[a]

Stability class	Description	Exponent, p
A	Very unstable	0.15
B	Moderately unstable	0.15
C	Slightly unstable	0.20
D	Neutral	0.25
E	Slightly stable	0.40
F	Stable	0.60

[a] For smooth terrain, multiply p by 0.6; see Table 7.8 for further descriptions of the stability classifications used here.

Source: Peterson (1978).

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

[a] The computed values of σ will be in meters when x is given in kilometers.

Source: Martin (1976).

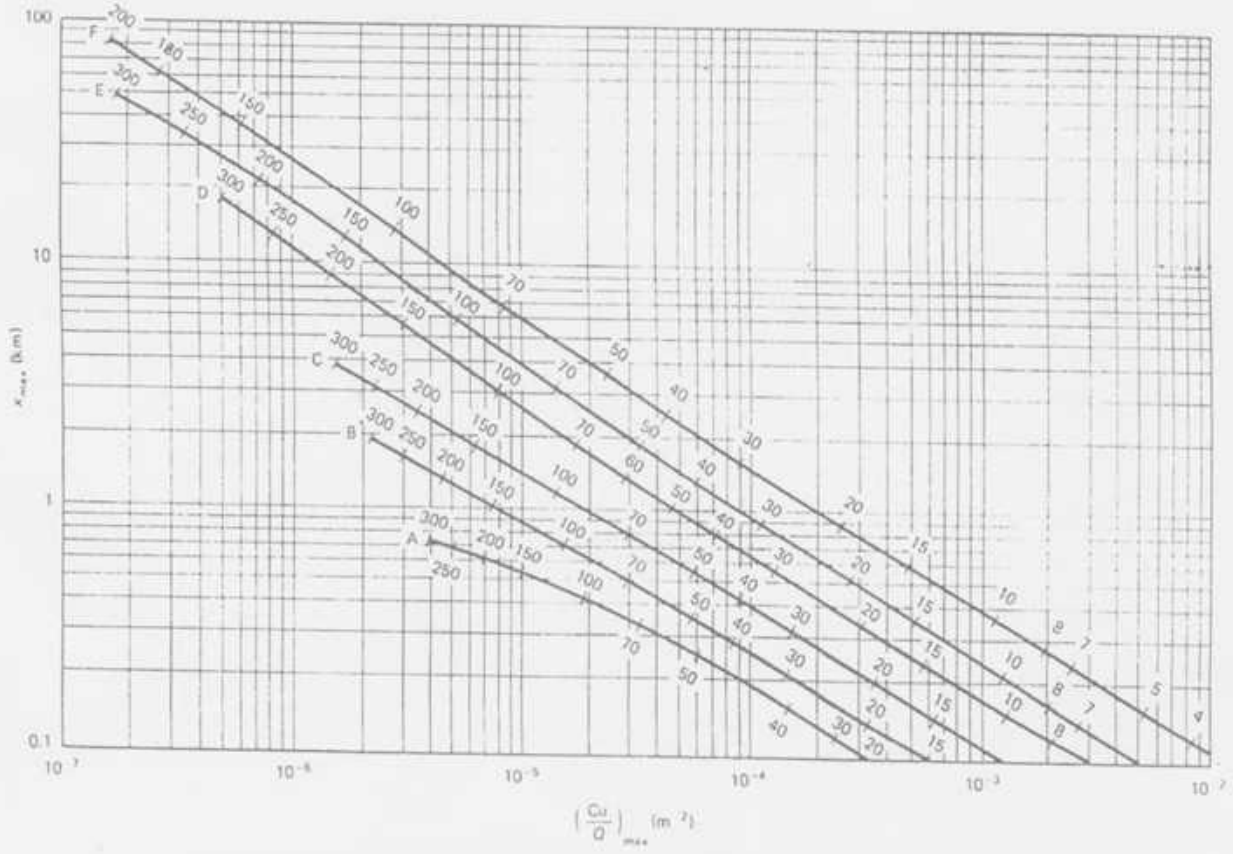


Figure 7.30 To determine the peak downwind plume concentration, enter the graph at the appropriate stability classification and effective stack height (numbers above the lines, in meters) and then move across to find the distance to the peak, and down, to find a parameter from which the peak concentration can be found (Turner, 1970).

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

Course title: Environmental Engineering VII | Course code: CE 439
Time: 120 minutes | Full marks: 50

There are SIX (6) questions. Answer question no. 01 (COMPULSORY) and any THREE (3) from the rest.

1. A) Define the following: 8
   - Environmental Impact Assessment (EIA)
   - Ecosystem
   - Scoping
   - Impact analysis
   - Impact mitigation
   - Environmental management plan
   - EIA review
   - Environmental Auditing

   B) Draw the flow diagram of EIA process and parallel studies. 6

2. According to Environmental Conservation Rules (1997) of Bangladesh, in which category the following industrial units and projects can be classified (i.e. Green, Orange A, Orange B, Red)? 3

Industrial Unit/Project	Category
Tea processing	
Medical and surgical instruments (excluding production)	
Dry-cleaning	
Power plant	

   B) According to Article 7 of the Bangladesh Environmental Conservation Rules (1997), write the procedures to obtain environmental clearance certificate for a red category factory. 6

   C) Explain four main types of social impacts. 3

3. Write the name of your own group work's project.

   One of the following projects: a) Rampal Thermal Power Plant b) Padma Multipurpose Bridge Project c) Mass Rapid Transit in Dhaka City d) Rooppur Nuclear Power Plant.

A) Identify the three most important impacts of your project. Write only the names. 2

B) Graphically show the time versus impact significance of these three impacts at different phases of your specific project. Draw three different figures for three selected impacts. 10

(Examples of different phases of the project are: *before the project started, at planning/initiation phase, at implementation/construction phase* and *at operational phase/after construction phase* etc.)

4. A) What are the typical parameters (impact characteristics) that need to be taken into account for impact prediction and decision-making in an EIA process? 4

B) Produce an EIA sample impact identification checklist for your own group work's project. 8

For one of the following projects: a) Rampal Thermal Power Plant b) Padma Multipurpose Bridge Project c) Mass Rapid Transit in Dhaka City d) Rooppur Nuclear Power Plant.

5. A) What are the key principles for the application of impact mitigation consistent with the main elements of impact mitigation? 4

B) Government is proposing to construct a new export processing zone (EPZ) in an area covering 450 Acres. After completion, the EPZ will have 250 industrial plots. The area proposed for the new EPZ is located in a rural area mainly used for agriculture and there is a river nearby. 8

For this project, write the benefits of public participation during EIA process for the following stakeholder groups (write five benefits for each stakeholder group):

- The proponent/supporter
- The decision-maker
- Affected communities

6. A) Elaborately explain six different components of Environmental Management Plan. 4

B) Explain the main steps of EIA review. 4

C) Graphically show three different steps of Environmental Auditing (EA). 4

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
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, in short, four purposes of subsurface exploration (geotechnical). Step down the phases (mention names only) of geotechnical subsurface exploration. 4+2 = 6

   (b) Make a comparison on the extent and significant depths up to which exploration is generally intended from the perspective of geotechnical engineering with other types of exploration as such in the field of agricultural and petroleum engineering. 4

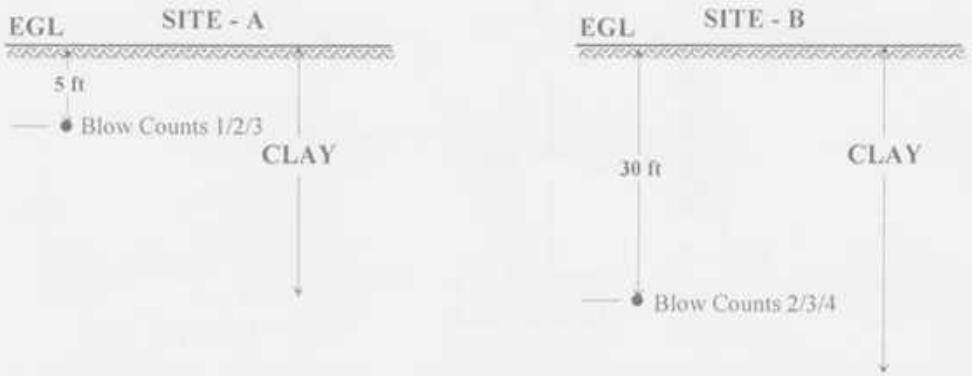
   (c) Mention four observations that should be noted by a good geotechnical engineer while visually inspecting the site as a part of reconnaissance phase of a subsurface exploration program. 4

   (d) Discuss on the occurrence of disturbances during sampling of both cohesive and cohesionless soils. 6

2. (a) Write short notes (any two): 3.5 x 2=7

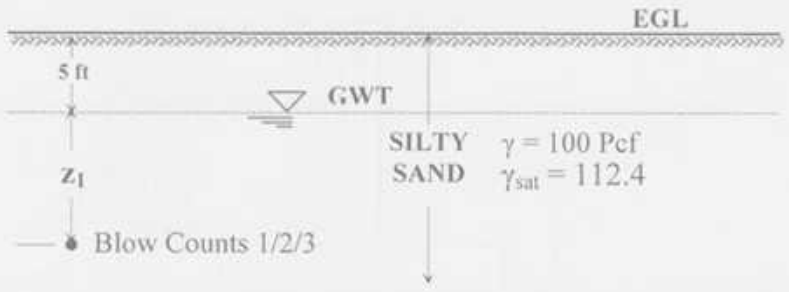
   (i) Depth of boreholes to be drilled (ii) Drilling & logging (iii) Pressuremeter test

   (b) A sample was collected from a site, **SITE - A** having a borehole diameter of 4 inches and hammer efficiency of 0.5. CF_{60} for this site was estimated to be 0.75. Determine whether liner was used or not at this site. With the same sampler, having same hammer efficiency another sample was sampled from **SITE - B**. CF_{60} for this site was estimated to be of 1.15. Determine the diameter of the borehole drilled at the second site. Also estimate the shear strength parameters (c) for these two sites. 6



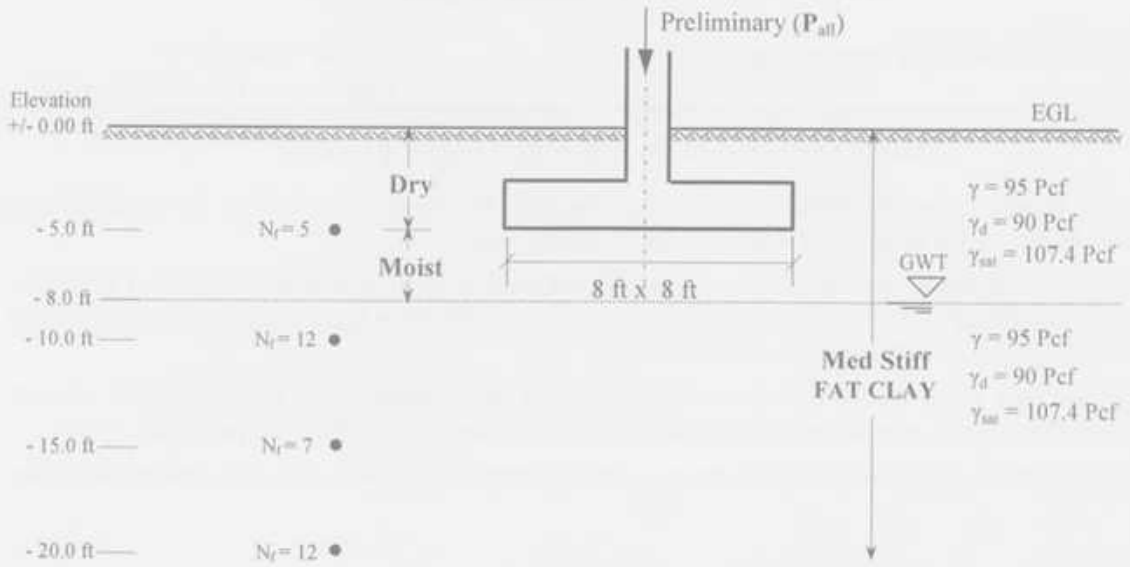
   (c) A standard penetration test (SPT) was conducted at a site. Using the following information relevant to this test, compute z_1. 7

   - Angle of internal friction of the sand sample was estimated to be 28.25 degrees.
   - CF_{60} was estimated to be 1.0

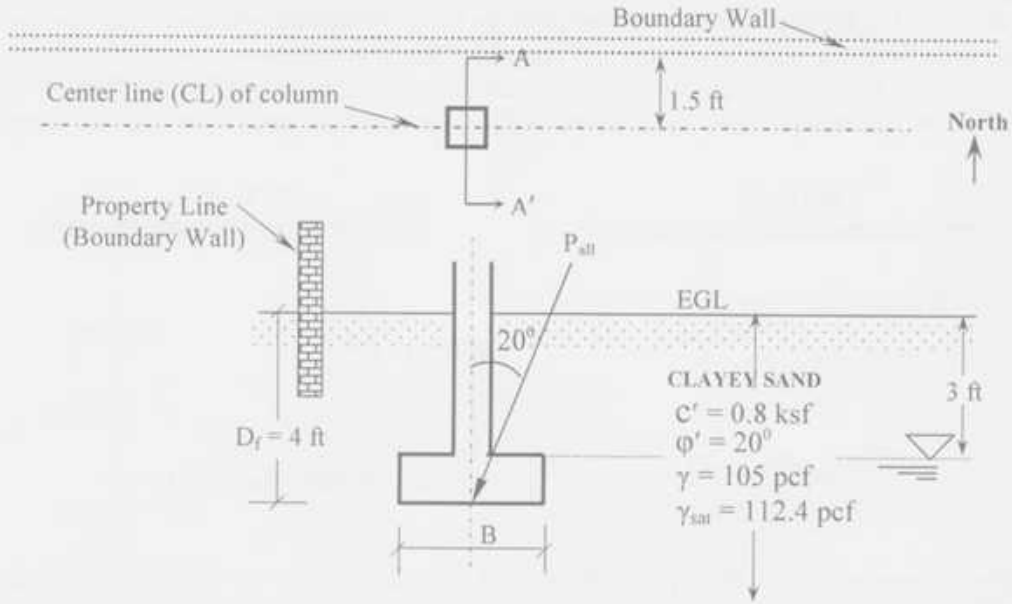


3. (a) During a field investigation SPT-N values were obtained at each 5-foot depth intervals. Using Terzaghi's bearing capacity equation (as appropriate), calculate the allowable column load for the individual column rectangular footing for condition shown in the figure in next page. Use FS = 3. 9

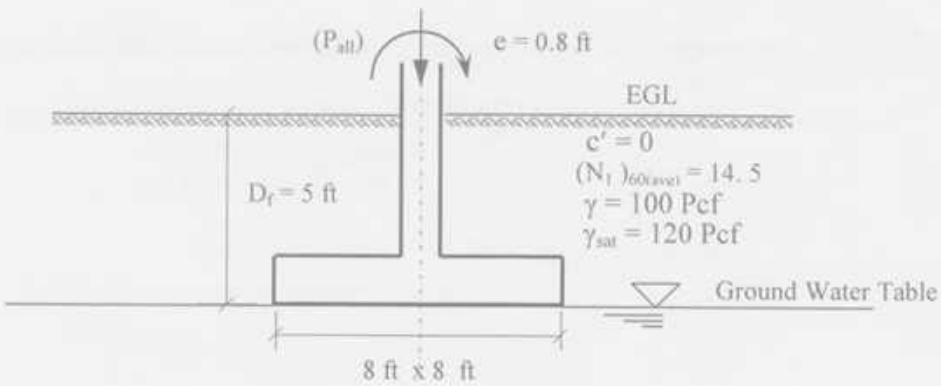
NOTES: No laboratory tests were conducted to obtain the shear strength of the clay formation. Use empirical correlation to estimate the average shear strength below the foundation level and use that for estimating preliminary allowable column load. Assume $CF_{60} = 1.0$



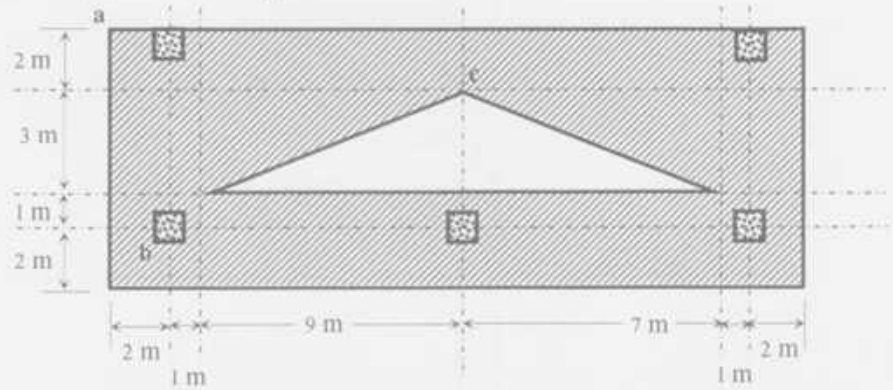
(b) For the following conditions, determine the allowable column load (P_{all}) for a rectangular footing as shown below: (i) Foundation spread cannot go beyond the interior of the boundary wall (ii) Column location cannot be moved (iii) L = 2B. 11



4. (a) An eccentrically loaded foundation is shown below. Determine the allowable load the foundation can carry. Use Meyerhof's effective area method and FS = 2.5. 7



(b) The plan of a mat foundation is shown below. Column load for all corner columns is 400 kN each and other column is 800 kN. Size of each columns 800 mm by 800 mm. Calculate soil pressures at points a, b, c and at the geometric centroid of the mat foundation. 13

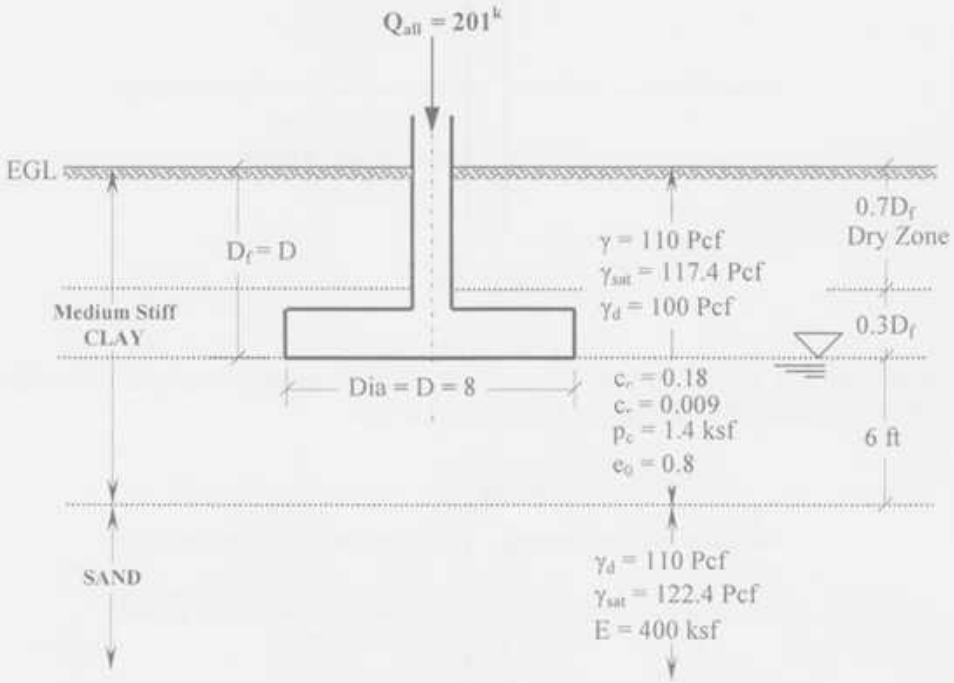


5. (a) Depict and write a short note on punching shear failure pattern for shallow foundation. 3

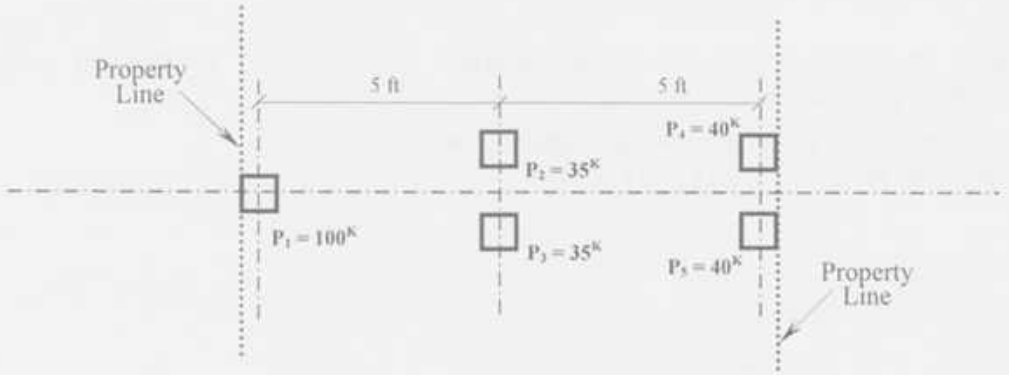
(b) Compare the strength/advantage and weakness/disadvantage of Terzaghi's bearing capacity equation and general bearing capacity equation. 3

(c) Define shallow and deep foundations. 2

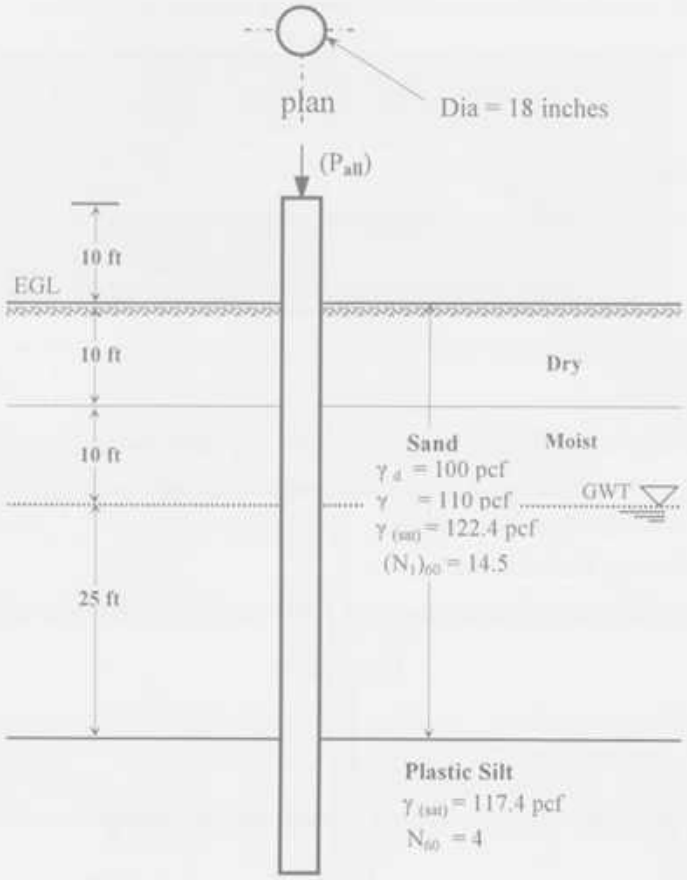
(d) For the following conditions calculate the total settlement (consolidation and elastic). 12



6. (a) For the following loading, geometric and boundary conditions a trapezoidal combined footing is designed. According to analysis, the dimension of the shorter parallel of the trapezoid was estimated to be 7.1 feet. Estimate the other dimension of the longer parallel and allowable bearing capacity for the system. Consider all column dimensions as 12-inch by 12-inch. 9

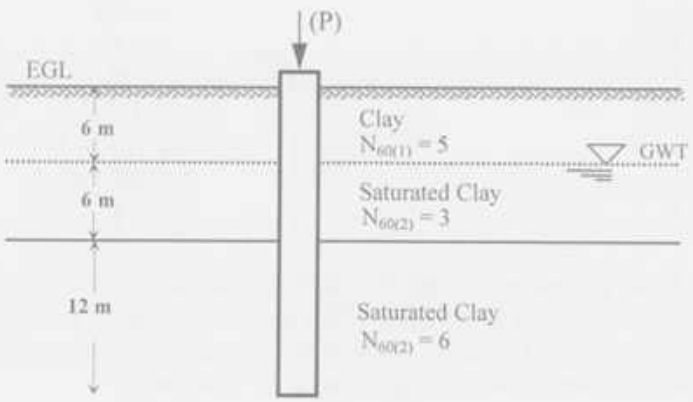


(b) A 70-foot long solid concrete bored pile is installed as shown below. Calculate the allowable capacity (P_{all}) of the pile for a factor of safety of 2 for skin friction and of 2.5 for end bearing resistance. 11



section

7. (a) For the soil stratigraphy as shown below, a pre-cast solid concrete driven pile (400 mm by 400 mm) was installed. Calculate the capacity of the individual pile. 8



(b) Categorize shallow and deep foundation systems. Draw sketches of different combined footings. No description is required. 8

(c) Draw arrangement of group piles for the following sets of piles. 4
(i) Double row for a wall (ii) 11 piles

8. (a) Categorize (no description required) conventional retaining walls. Show sketch of a frequently used one. Show with sketches the major alternatives (steps) that can be investigated to obtain the desired factor of safeties in designing conventional retaining walls. 8

(b) Mention (names only) a few features incorporating slope stability issues. 2

(c) Determine the factor of safety (stability) against the failure arcs through the slope for the slope as shown below. 10

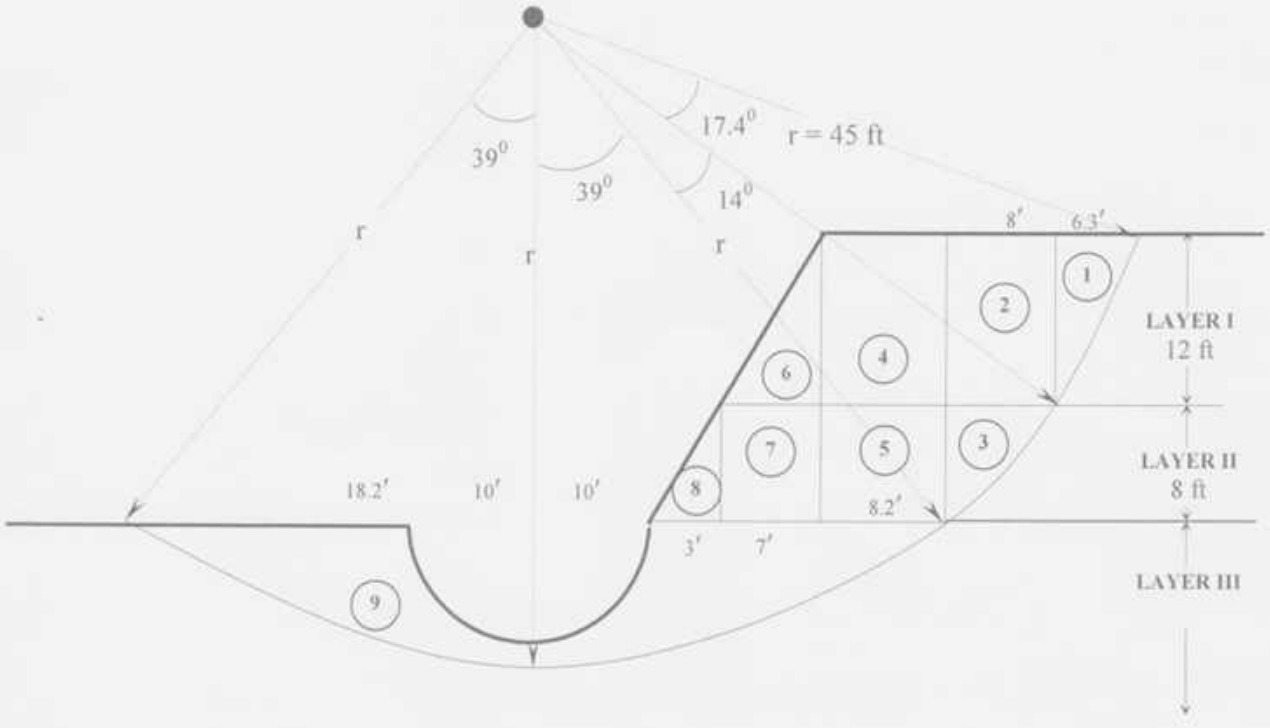
LAYER I:
Sandy Clay
Average SPT Blow Count, N = 6
Unit Weight = 115 pcf

LAYER II:
Clay
Average SPT Blow Count, N = 10
Unit Weight = 120 pcf

LAYER III:
Clay
Average SPT Blow Count, N = 12
Unit Weight = 125 pcf

Segment No.	Area (ft^2)	Arm (ft)
1	*	38.3
2	96	*
3	32	*
4	98.4	24.1
5	*	*
6	*	*
7	56	*
8	*	*
9	228	0

*To be calculated



4-1

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc Engineering (Civil)

Course Title: Transportation Engineering II: Highway Design & Railways — Course Code: CE 451
Time: 3 Hours — Full Marks: 150

Section- A :Answer any 3 (Three) out of 4 (Four)

1. (a) Define Gauge. Why a country should have a uniform gauge? (3+10)
   (b) Write down the functions of the rail. What are the advantages of flat footed rail? What does it mean by 45 kg rail and what will be the maximum axle load for it? (5+4+3)

2. (a) Write short note on Dual-gauge Tracks. What are the considerations for choosing the gauge of a rail? (5+10)
   (b) What are the functions of the ballast? How you will choose the rail length? What are the advantages of welded rail? (3+3+4)

3. (a) Why joints are placed in Rigid Pavement? What are the requirements of joints in pavement? (5+8)
   (b) Describe the basic requirements of an ideal alignment for a roadway? (12)

4. (a) What are the functions of railway components? Why should you need to study Railway Engineering? (5+5)
   (b) Why coning of the wheel is done? What are the advantages of tilting of the rail? What are the advantages and the disadvantages of the concrete sleeper? (5+10)

Section- B :Answer any 3 (Three) out of 4 (Four)

5. (a) What are the common locations of wear on rail? What reasons act behind the wear of rail? How can you reduce the wear of rail? (4+5+6)

   (b) Compute the steepest gradient that a train of 25 wagons with a locomotive can travel with the following data: (10)
   (a). Weight of each wagon 15 tonnes
   (b). Weight of Locomotive 160 tonnes
   (c). Tractive effort of Locomotive ~~3.5 kg/ tone~~ 15 tonnes
   (d). Rolling resistance of wagon 3 kg /tone
   (e). Speed of the train 65 kmph
   f) Rolling resistance of Locomotive 3.5 Kg /tone

6. (a) Why do you think the geometric design of railway track is so important? (10)
(b) Combine the following aggregates to meet the specifications. (15)

Pasing size	Retained sieve	Percent by weight			Specific Limit
		CA	FA	MF	
¾"	½"	5	--	--	0-5
½"	3/8"	35	--	--	8-42
3/8"	#4	38	--	--	8-48
#4	#10	17	8	--	6-28
#10	#40	5	30	--	5-20
#40	#80	--	35	5	9-30
#80	#200	--	26	35	5-8
#200		--	1	60	2-6
Total		100	100	100	

CA (Minimum- Maximum) Range in total mix= 55%-60%
FA (Minimum- Maximum) Range in total mix= 38%-45%
MF (Minimum- Maximum) Range in total mix= 2%-6%

7. (a) Explain the factors those affecting the selection of a railway alignment? (12)

(b) Calculate the maximum permissible load that a N.G. steam locomotive with 4 pairs of driving wheels with axle load of 22 tonnes each on a straight level track at speed of 22 m/s. Also calculate the reduction in speed if the train has to run on a rising gradient of 1 in 200. (13)

What would be the further reduction in speed if the train has to negotiate a 4 degree curve on the rising gradient? Assume coefficient of friction 0.2.

8. (a) Make a comparison among Intercity, Urban and Sub-urban railway system. What is the Maglev Principle? (10)

(b) List the different Train Resistances, their formula, and name the each parameter in formula. (5)
(c) Write down the amount of grade compensation for different gauges of railway. (5)
(d) How can you solve the transportation problems in Dhaka city incorporating the railway system? (5)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

Course title: Irrigation and Flood Control | Course code: CE 461
Time: 3 hours | Full marks: 100

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

SECTION A
MARKS: 72

There are SIX questions. Answer question no. 01 (COMPULSORY) and any THREE from the rest. (Assume any missing data.)

1. a) Define irrigation. Write the benefits of irrigation and the harmful effects of excess irrigation. 2+4
   b) What are the different methods of irrigation water distribution? Describe check flooding method along with its advantages and disadvantages. 2+4
   c) What are cross-drainage works? Explain the necessity of cross-drainage works. 3
   d) Define spillway. Explain the necessity of spillways. 3

2. a) Explain river training works. What are the purposes of guide banks? 2+2
   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. 7

Month	Monthly temperature (°C) 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
November	18.0	7.20	1.7
December	15.0	7.15	1.42
January	13.5	7.30	3.01
February	14.5	7.10	2.75

c) Estimate the possible change in soil salinity owing to evaporation of 9 cm ground water having an electrical conductivity of 10 mmhos/cm over a period of 3 months. The 30 cm depth of soil has a mean bulk density of 1.45 g/cm^3 and saturation point of 40 percent. The density of water is assumed as 1 g/cm^3. It is considered that the 30 cm depth of soil will be affected by the rise in salt concentration. 7

3. a) Derive the relationship between duty and delta for a given base period. 3
   b) Explain the following with neat sketch: i) Aqueduct ii) Super passage iii) Level crossing. 6
   b) A stream of 130 liters per second was diverted from a canal and 100 liters per second were delivered to the field. An area of 1.6 hectares was irrigated in 8 hours. The effective depth of root zone was 1.7 m. The runoff loss in the field was 420 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. Irrigation was started at a moisture extraction level of 50% of the available moisture. 9
   Find out the following:
   - water conveyance efficiency
   - water application efficiency
   - water storage efficiency

4. a) Draw the schematic diagram of soil-water-plant relationship. 3
   b) Graphically demonstrate the following (in one figure): 5
   - Capillary water
   - Hygroscopic water
   - Optimum moisture content
   - Readily available moisture
   - Permanent wilting point
   - Field capacity

   c) After how many days will you supply water to soil in order to ensure sufficient irrigation of the given crop, if, 10
   - Field capacity of the soil = 30%
   - Permanent wilting point = 14%
   - Dry density of soil = 1.3 gm/cc
   - Effective depth of root zone = 77 cm
   - Daily consumptive use of water for the given crop = 12 mm
   - Readily available moisture is 75% of the available moisture.

5. a) Explain free board and berms. What are the purposes of free board? 2
   b) Draw the typical layout of diversion head works. What are the objectives of diversion head works? 4
   c) Explain the procedures for determining the required discharge capacity and number of spillways. 4
   d) The cultivable command area of a distributary is 4800 hectares. The intensity of irrigation for Rabi season is 50 % and that for Kharif season is 25%. If the average duty at the head of the distributary is 2000 hectares/cumec for Rabi season and 900 hectares/cumec for Kharif season, find out the discharge required at the head of the distributary from average demand considerations. 8

6. a) Define weir and barrage with neat sketch. 2.5
b) What is spur? Explain different types of spur with neat sketch. 3.5
c) Explain the following: i) Silt factor ii) Critical velocity ratio iii) Hydraulic mean depth iv) Regime channel 6
d) Design a lined canal having the following data: 6
Full supply discharge = 200 m^3/sec
Side slope = 1.25:1
Bed slope = 1 in 5000
Rugosity coefficient = 0.018
Permissible velocity = 1.75 m/sec
Assume other reasonable data for the design.

SECTION B
MARKS: 28

There are THREE questions. Answer question no. 07 (COMPULSORY) and any ONE from the rest. (Assume any missing data.)

7. a) Define the following: i) Integrated water resources management ii) Flood iii) Flood control iv) Flood management 6
b) What are the structural and non-structural measures of flood control and management in Bangladesh? 5
c) For effective and peaceful management of Ganges river basin, shared by Bangladesh, India and Nepal, which three water law principles are most important in your opinion? Justify why these three principles could be beneficial for Bangladesh, India and Nepal for reducing water conflict, increasing irrigation and mitigating floods hazards along Ganges river basin. 5

8. a) Explain the delta formation process and how delta formation process relates to flood. 4
b) Explain six reasons of floods in Bangladesh. 4
c) Write six reasons why transboundary cooperation is needed for increasing food production and mitigating and minimizing floods hazards along the Ganges and Brahmaputra rivers basins inside Bangladesh. 4

9. a) Graphically show the different components of *unified city flood management*. 3
b) Describe how centrifugal pump works with neat sketch. 3
c) A centrifugal pump is required to lift water at the rate of 115 liters/sec. Calculate the brake horse power of the engine from the following data when the water is directly supplies to the field channel: 6

- Suction head = 5.90 m
- Coefficient of friction = 0.01
- Efficiency of pump = 74%
- Diameter of pipe = 14 cm

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
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) What are the postulates of Rutherford's solar system atom model? 5
   b) Define proton number (Z), mass number (A) and neutron number (N). Establish the relationship between Z, A and N. Uranium has atomic number 92 and atomic weight 238.029. Find its number of electron, proton and neutron in its atom. 10
   c) Define isotope. Name and draw the atomic structure of hydrogen isotope. Discuss Rutherford's gold foil experiment for the discovery of the nucleus of atom. 10

2. a) What is ionic bond? Prove that NaF and K_2S compounds have ionic bonds. 5
   b) Discuss covalent and co-ordination bonds with examples. Based on the valence bond theory (VBT)- explain the formation of covalent bond in the HF and F_2 molecules. 10
   c) Distinguish between sp2 and sp3 bonds. Show the bond formation in $BeCl_2$, BF_3 and CH_4 molecules. 10

3. a) Draw a physical view of solution. Indicate the states of solute and solvent in the following solutions: i) air, ii) steel. 5
   b) Discuss physical and chemical solutions based on NaCl and $ZnSO_4$ systems. What is supersaturated solution (SSS)? How SSS can be prepared? 10
   c) Discuss the energetics and mechanism for the dissolution of NaCl in water. 10

4. Write note on: $12.5 \times 2 = 25$
   i) Quantum numbers: l and m_l
   ii) Properties of ionic bonds.

Section-B

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

5. a) State and explain solubility and dynamic equilibrium. 5
   b) Prove that solubility of a saturated solution is constant. 10
   Discuss the influence of temperature on solubility of a solid in liquid.
   c) What is solubility curve? 10
   Draw various types of solubility curves.

6. a) Establish a relation between heat (Q) and temperature (T). 5
   b) Define enthalpy (H) and internal energy (E). 10
   Prove that $\Delta H = \Delta E + \Delta nRT$
   Predict and thus explain the heat of formation for the following reaction:
   $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$, $\Delta H = -44.0$ kcal
   c) Discuss heat of combustion and heat of neutralization with examples. 10
   Heat of combustion of ethylene at 17 °C and at constant volume is -332.19 kcal. Calculate the heat of combustion at constant pressure.

7. a) What is chemical kinetics? Name the factors that influence the kinetics of the chemical reactions. 5
   b) Define reaction rate with graphical representation. 10
   Describe instantaneous rate, average rate and initial rate.
   c) What is meant by 1st order reaction? 10
   Derive the integrated rate law and half-life of a 1st order reaction.
   30% of a 1st order reaction is completed in 60 min. Find i) the value of k and ii) time to complete 60% reaction.

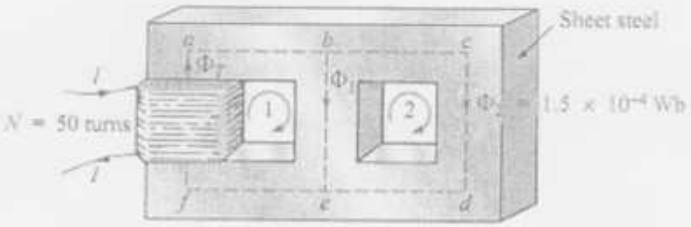
8. Write note on: $12.5 \times 2 = 25$
   i) Kirchoff's equation
   ii) Order and molecularity

The University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc Engineering (Civil)

Course Title: Basic Electrical Engineering Course No. ECE 201 Credit Hours: 3.00
Time: 3.00 Hours Full Marks: 150

[There are **Eight** questions. Answer any **Six**. Figures in the right margin indicate marks]

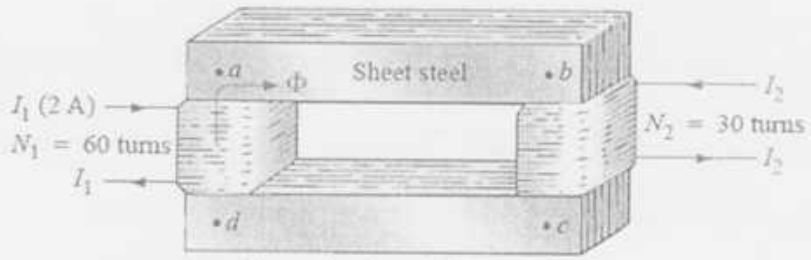
1. a. Determine the current I required to establish a flux of $1.5 \times 10^{-4} Wb$ in the section of the core shown in figure 1 [15]



$l_{bcfe} = l_{afed} = 0.2$ m
$l_{ba} = 0.05$ m
Cross-sectional area = 6×10^{-4} m² throughout

Figure 1

b. Determine the secondary current I_2 shown in figure 2 if the resultant clockwise flux in the core is $1.5 \times 10^{-5} Wb$. [10]



Area (throughout) = 0.15×10^{-3} m²
l_{abcda} = 0.16 m

Figure 2

2. a. Prove that, the energy stored in the magnetic field of an inductor is $W = \frac{1}{2}Li^2$ [13]

b. Find the equivalent capacitance C_{eq} for the circuit shown below [12]

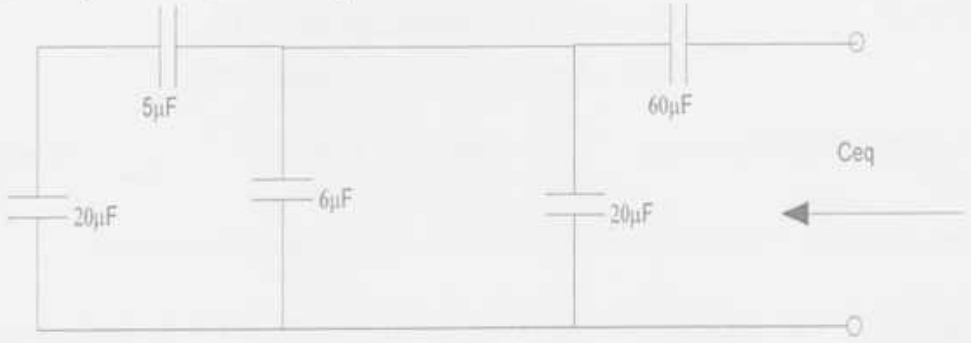


Figure 3

3. a. If $v_1 = -10\cos(\omega t + 30°)$ *and* $v_2 = 20\cos(\omega t - 45°)$, find $v = v_1 + v_2$ [10]

b. Determine the input impedance Z_{in} in the circuit shown below (consider ω=10 rad/s) [15]

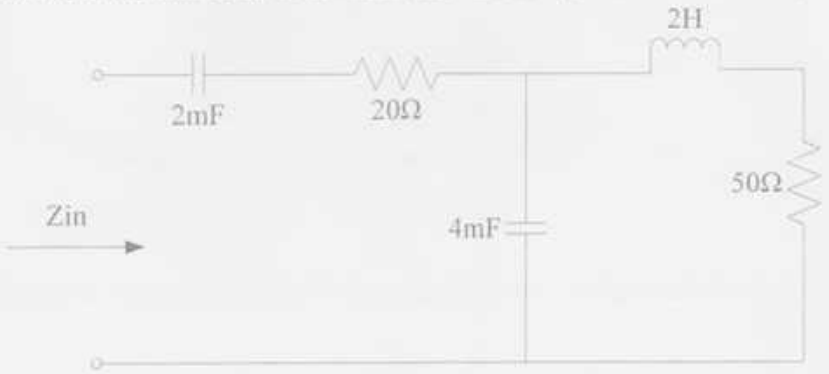


Figure for question 4

4. a. Calculate the average power absorbed by an impedance **Z**=30-j70Ω when a voltage V=120∠0° is applied across it. [12]

b. For an AC current $I = I_m \sin(\omega t)$, prove that, its r.m.s value is $Ir.m.s = \frac{I_m}{\sqrt{2}} = 0.707I_m$. [13]

5. a. Find the Thevenin equivalent circuit for the following network shown below [15]

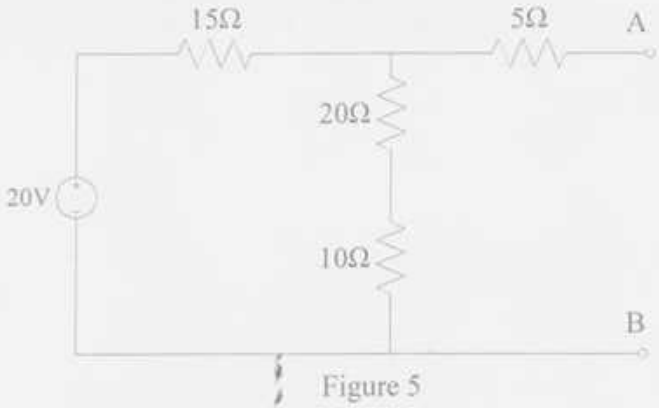


Figure 5

b. For what value of load resistance, R_L connected in AB point, the network will supply maximum power? What is the maximum power for this circuit? [10]

6. a. Calculate the equivalent resistance R_{ab} at the terminal a-b of the circuit shown below. [12]

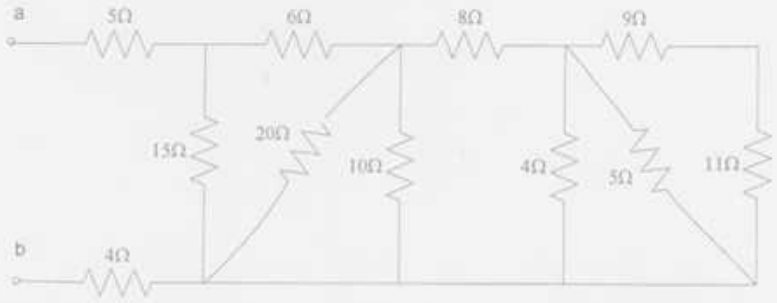


Figure 6

b. Use source transformation to find i_o in Figure 7 [13]

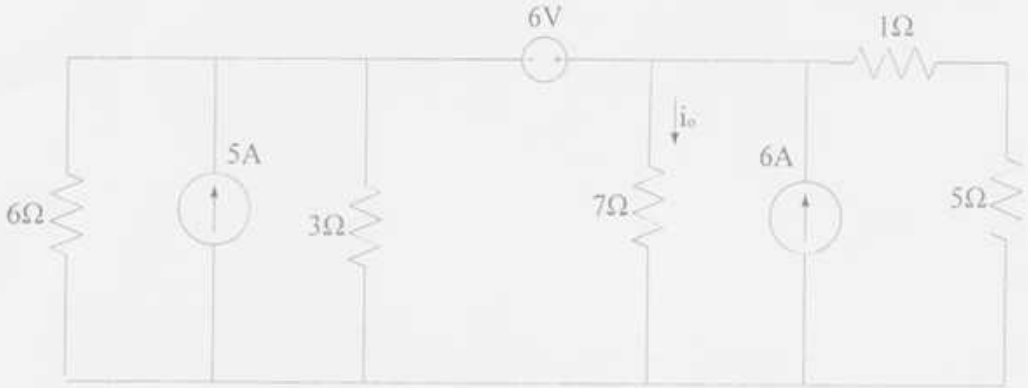


Figure 7

7. a. Determine v_1, v_2 of the circuit using nodal analysis [15]

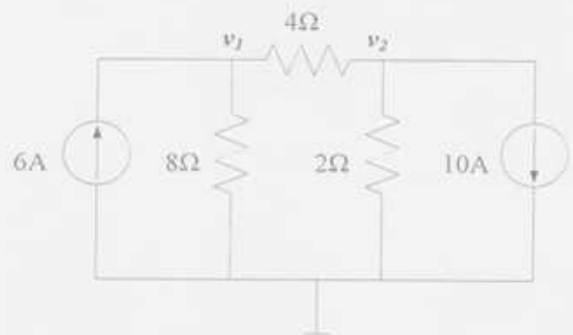


Figure 8

b. Define Independent and Dependent Sources of a circuit. Classify dependent sources. [10]

8. a. Use mesh analysis to find i_1 and i_2 in the circuit shown in figure 9 [13]

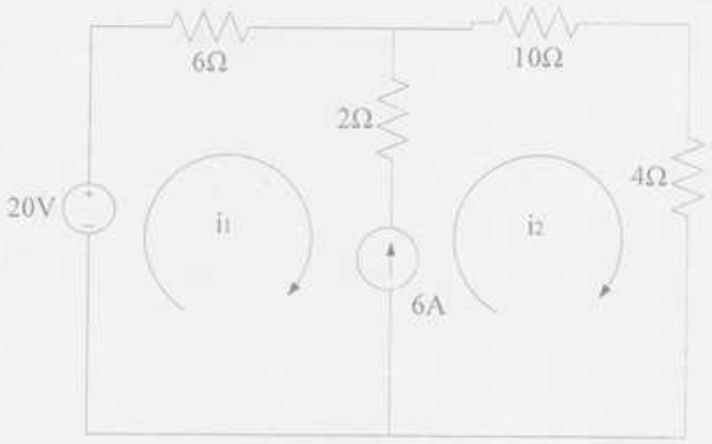


Figure 9

b. Find I and V_{ab} in the circuit [12]

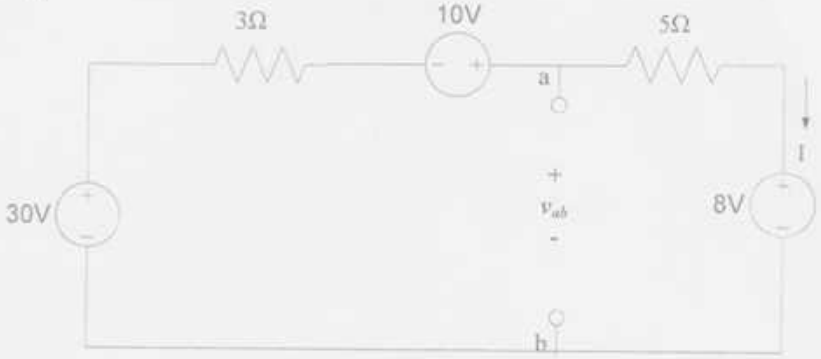
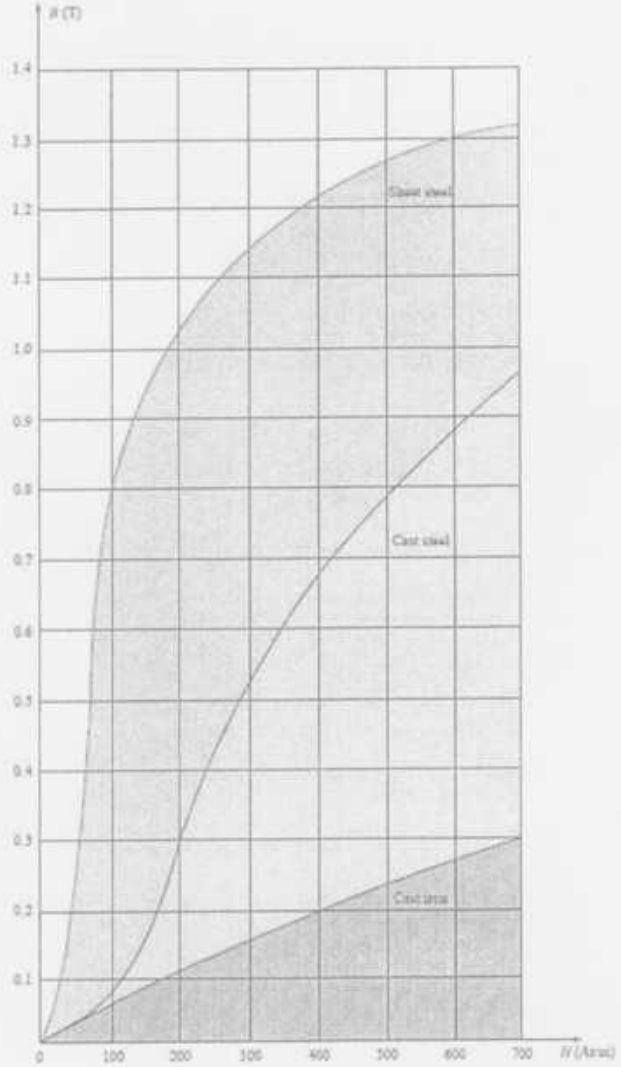


Figure 10



Expanded view for the low magnetizing force region.

Figure for Question 1(a) & 1(b)

University of Asia Pacific
Department of Civil Engineering
Semester Final Examination, Spring-2014
Program: B.SC Engineering (Civil)

Course Title: Principle of Economics Course Code: ECN 201 Credit: 2.00

Time: 2 Hours Full Marks: 50

Answer any **five** from the following questions:

1. (a) What are the features of monopoly ? Explain deadweight loss with a diagram. (7)

   (b) In case of a monopolist: P= 150-2Q, TC= 4Q+4

   Find out the profit maximizing price and quantity for this monopolist. (3)

2. (a) What is GDP? What are the methods of calculating GDP? Explain. (8)

   (b) Explain the problem of "Double counting". (2)

3. (a) What is Price discrimination? Explain different types of price discrimination. (7)

   (b) Show the differences between GDP Deflator and CPI. (3)

4. (a) Suppose price of a consumer basket of goods in year 2000=260 and in 2010=290

   Find the CPI in 2010. What is the inflation rate for 2010? [Base Year= 2000] (5)

   (b) Describe the consequences of inflation. (5)

5. Explain different types of unemployment. (10)

6. How can an economy recover from recession? Which policy should be taken during recession? Explain (10)

University of Asia Pacific
Semester Final Examination (Spring-2014)
Programme: B. Sc Engineering
Department of Civil Engineering
Year: 1st Semester: 1st

Course Code: HSS 101 **Course Title: English Language I**
Time: 3 Hours **Full Marks: 50**

*Marks are indicated in the right margin

Section A

1. **Read the following passage and answer the questions that follow:**

Every project manager should have a vision, a vision of how to get things done and a vision of the near future of the project. And he needs to be able to convey this vision to his team members. Only when there is vision is there going to be real involvement on the part of the project manager and thus involvement on the part of the team members. This is when he and the team members start feeling like a part of the organization and not just the project. He should also have the right visionary approach in setting the goals for the project.

Most would say communication is the most important skill of a project manager and some would beg to differ. But communication is an integral part of the leadership qualities. Without communication he cannot lead. Communication not only allows for great leadership but also for openness and relativity. Persuasion and negotiation are all a part of communication. Being a good communicator helps in setting the guidelines for the project that are acceptable to all.

The project manager should be approachable to all the members of the team. Many lower level members do not directly report to the manager. However, he should be easily approachable by the members in case of any queries or problems. He should also be open to any suggestions that are given by the members.

Everyone needs motivation. The project manager should motivate all his team members to work better. This is needed the most when the team is facing a tough time. Few words of motivation from the manager can boost the spirit of the members. Appreciating the work done by the members is a good way of motivating them.

He should be able to delegate with ease. He should be able to recognize skills and expertise of his team members and assign or delegate tasks according to those. Also this shows that he trusts the team in doing tasks. Trust inspires confidence and the team members tend to put in their best efforts.
He should also be a team builder. He should be able to hold and pull the team together to work under different conditions. The team starts as a group of strangers and needs to be made into a core group of people. Keeping the sense of team spirit alive despite the many problems in the project execution is one of the most important qualities a project manager should have.

1.1. Write the answer of the following questions in your own words: **4x1=4**

a) On what basis should the manager delegate?
b) How can a manager motivate his team?
c) What is the importance of building a team?
d) Make a list of the qualities that a project manager should have.

1.2. Choose the correct answer: **4x1=4**

a) Having a vision helps to
i. make a team
ii. get involved with the organization
iii. go against the goal
iv. uplifts the spirit

b) An approachable project manager facilitates
i. better understanding
ii. to set a goal
iii. for easy interaction among all levels
iv. to make friends

c) Persuasion and negotiation are parts of
i. team Work
ii. management
iii. communication
iv. trust

d) Delegation should depend on
i. expertise
ii. confidence
iii. tasks
iv. qualification

Section B

2. Fill in the blanks with the appropriate parts of speech. **0.5x10=5**

a) The _____ (science) discoveries amaze the world.
b) The _____ of the students will be proved through the tests. (Intelligent)
c) I take it very _____. (serious)
d) It was not an _____ death. (accident)
e) The _____ of the stage was beautiful. (decorate)
f) This is the _____ part of the story. (fun)
g) Human beings are fond of _____. (free)
h) They did the work most _____. (effect)
i) He _____ unjust power on the poor. (exercise)
j) Try to be _____ till the end of your life. (truth)

3. Fill in the blanks of *any four* sentences with appropriate homophones conforming to their respective IPA transcriptions. **5x1=5**

a) ___ forgot that my ____ has become red. **(/ai/)**
b) Did you ____ that I asked you to come _____? **(/hɪə (r)/)**
c) My _____ has _____ all the cookies. **(/meid/)**

d) This is the _____ lady we saw at the _____. **(/feə(r)/)**

e) _____ from the _____ side. **(/rait/)**

4. Use the suffix/prefixes **en-, be-, dis-, -ify, -ise, -ment, -al, -ive, -ly** to **any four** of the following words and make sentences with the newly formed words: **4x1=4**

active, engage, friend, collect, body, agree, approve

5. Use the following words as **homographs** in two separate sentences: **3x1=3**

second, book, fine

6. Rewrite the following paragraph replacing and underlining the misspellings with correct answers: **0.5x8=4**

In research to be published in the jornal *Ecology* -- and curently posted online as a preprint -- Thomas Givnish, a profesor of botany at the University of Wisconsin-Madison, atempts to resolv this debaite by studying how tree height, resorce allocation and physiology vary with climate in Victoria state, locaited in southeastern Australia.

Section C

Answer any three from questions 7-11. **7x3=21**

7. Compare and contrast your school life and your university life. (250 words)

8. Describe an ideal village of Bangladesh. (250 words)

9. Write a letter to your friend in London asking him to send you a book that is unavailable in your city. (250 words)

10. Translate the following passage into English:

সংস্কারের অভাবে রাজধানীর সড়কগুলো চলাচলের অযোগ্য হয়ে পড়েছে। অনেক জায়গায় কার্পেটিং, পাথরকুচি ও খোয়া উঠে গিয়ে বড় গর্তের সৃষ্টি হয়েছে। এছাড়া গত তিন দিনের বৃষ্টিতে খানাখন্দ ও গর্তে ভরা এই সড়কগুলোর অবস্থা আরও খারাপ হয়েছে। বৃষ্টির পানি জমে সৃষ্টি হয়েছে জলাবদ্ধতা ও দীর্ঘ যানজট। নগরীর অভ্যন্তরীণ ২৩শ কিলোমিটার সড়কের মধ্যে প্রায় অর্ধেক সড়কেই এ অবস্থা। তবে সবচেয়ে খারাপ অবস্থা গলিপথগুলোর। সর্বত্র খানাখন্দ ও গর্ত। এর মধ্যেই ঝুঁকি নিয়ে যানবাহন ও পথচারিদের চলাচল করতে হচ্ছে। এছাড়া নগরীর প্রধান সড়কগুলোতে লাগোয়া নালা না থাকায় সামান্য বৃষ্টিতেই দেখা দিচ্ছে জলাবদ্ধতা। দীর্ঘদিন থেকে ঢাকা সিটি করপোরেশন মেরামতের উদ্যোগ না নেয়ায় নগরীর রাজপথ ও অলিগলির এই অবস্থা সৃষ্টি হয়েছে বলে জানান স্থানীয়রা।

University of Asia Pacific
Department of Civil Engineering

Semester Final Examination: Spring 2014

Program: BSc Engineering

Course Code: HSS 103 Course Title: English Language II Credit: 3.00

Time: 3.00 Hours Full Marks: 50

* Marks are indicated in the right margin

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1. Read the following passage and answer the questions that follow:

Long ago goods were manufactured by craftsmen, who were skilled workmen. A craftsman was proud of each article he made. He spent a long time in making it and took great care over its manufacture, and people paid a high price for it when it was finished. All the luxurious Persian carpets, the beautiful Chinese pottery and the handmade lace of certain European countries were made in this way. But these articles were bought only by the rich. Poorer people had to be satisfied with goods that were roughly and cheaply made.

When the population of Europe increased, there was a demand for goods of better quality. These goods had to be produced in factories and workshops where hundreds of workers were employed. The invention of the steam engine helped manufacturers by giving them cheaper power to work their machines. Machines took the place of men. Production was increased. People were able to buy articles of good quality at low prices. The age of mass production had arrived. A 'mass' is a large number of quantity. Mass production means the manufacture of a large number of identical articles by the use machinery. Cars, radios and cameras are examples of the many type ofarticle that are mass produced today.

A conveyor belt plays a large part in mass production. By meansof the conveyor belt, which moves continuously, articles are conveyed from point to point during the various stages in their manufacture. A lot of time is saved in this way.

A visit to a factory is an interesting experience. Take, for example, a biscuit factory. The whole process of biscuit making is done by machinery. First of all, the ingredients such as flour, sugar, fat and water are put into a mixing machine. The mixture comes out of the mixing machine in the form of dough, and is passed on to a machine that presses the dough into moulds. In these moulds the dough is given the shape of biscuits. Then the biscuits are taken on a conveyor belt to the oven. As they move through the oven they are slowly cooked. When they are cool, they are taken off the moving belt by workers and packed into boxes. The boxes are weighed, made air-tight and wrapped. Then they are ready to leave the factory.

Now, answer the following questions: **01 x 07 = 07**

a) Why couldn't everybody buy the goods that were produced by craftsmen?
b) What kind of products did the poorer people buy?
c) What difference did the invention of stream engine make to the manufacture of goods?
d) What does a conveyer belt do?
e) What happens to the biscuits as they move through the oven?
f) Why do you think the boxes of biscuits are made air-tight?
g) What do you think are the principal benefits of mass production?

2. Rewrite any ten (10) of the following sentences using appropriate modal verbs: **0.5 × 10 = 05**

a) Possibly she isn't John's sister.
b) She was able to read when she was three.
c) It is not necessary for you to pay the bill.
d) I am certain that they have already left.
e) I was in the habit of going for a walk every morning when I was in Singapore.
f) It is probable that he will pass his driving test easily.
g) There's no doubt that the car was there at eight o'clock.
h) It was not necessary for them to buy a new car but they bought it.
i) I advise you to wake up early in the morning.
j) I am inviting you to have a dinner with us.

k) You are prohibited to entire without permission.

3. Join any ten (10) of the following pairs of sentences with appropriate conjunctions or relative pronouns: 0.5 x 10 = 05

a) He had injured his knee. He tried to play until the end of the match.
b) Laura is a popular athlete. Several foreign newspapers have published articles about her.
c) I talked to the girl. Her car had broken down in front of the shop.
d) I must put my glasses on. I won't be able to see very well.
e) Mr. Richards lives in London. He is a taxi driver.
f) She spoke very loudly. The old man still couldn't hear her.
g) He stood on the chair. He wanted to reach the top shelf of the bookshelf.
h) Thank you very much for your e-mail. It was very interesting.
i) He wrote an essay yesterday. He read a book too.
j) They tied the thief up. They didn't want him to escape.
k) James always visits the place. In this place his father died in a road accident.

4. Write single sentence definition of *any five* of the following: 01 x 05 = 05

a) Peace (negation) b) Nuclear family (synonym) c) Mobile phone (function)

d) Generator (function) e) Tiger (class) f) Electricity (description)

5. Write an application to your Head of Department seeking permission to arrange a study tour to Cox's-Bazar. 05

6. UAP is going to arrange an "Inter-Departmental Debate Competition". As the convener of UAP Debating Club, write a memorandum to this effect.
05

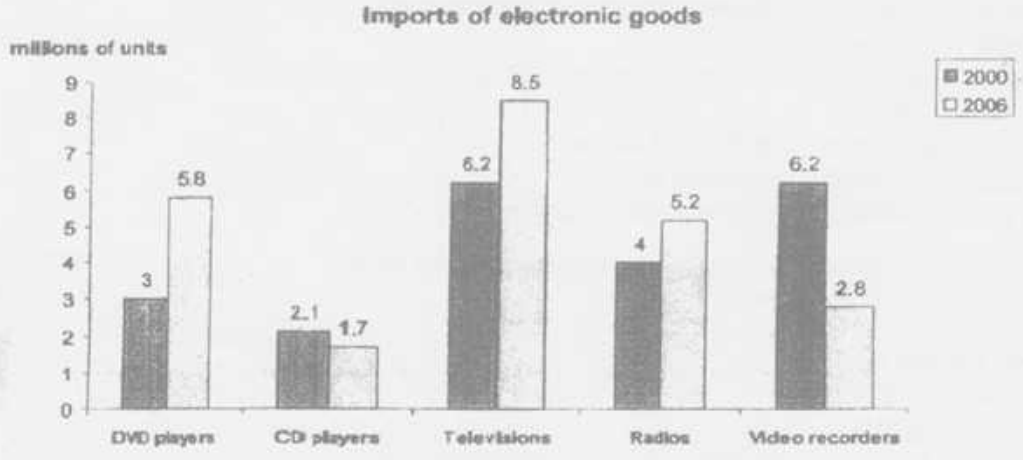
7. Recently, UAP has inaugurated a new campus at Farmgate. As a reporter, write a report on the whole event to publish in your newspaper. 05

8. Write a paragraph on any one of the following topics: 08

a) The qualities of a good student b) Sound pollution in Dhaka

9. The bar chart below shows the quantities of imports of certain electronic goods. Summarize the information by selecting and reporting the main features, and make comparisons where relevant.

05



University of Asia Pacific

Department of Basic Sciences and Humanities

Semester Final Examination, Spring 2014

Programme: 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 **SIX** questions. Answer any **FOUR.** (4x25)

Figures in the right margin indicate marks.

1. What are the major steps in social research? What are the major types of social research? Point out the advantages and disadvantages of survey method. 10+5+10

2. Define interview. State the differences between questionnaires and interviews. What are the merits and demerits of interviews? 5+10+10

3. Define economic institution. Discuss the main features of economic institutions of pre-industrial society. 5+20

4. What are the differences between crime and deviance? Discuss the causes of crime in Bangladesh. 8+17

5. Define political institution. Illustrate the functions of a government? Discuss the different types of governments. 4+8+13

6. What are the components of urban growth? Discuss the positive and negative consequences of urbanization. 10+15

University of Asia Pacific

Department of Basic Sciences and Humanities

Semester Final Examination, Spring 2014

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**

Answer any four (4x25)

1. What was *Permanent Settlement*? Discuss its objectives and effects.
2. What were the reasons behind the *Partiotion of Bengal(1905)*? Show the partition.
3. Who was the founder of modern Bengali prose? How did he contribute to the society?
4. What was the background of *Lahore Resolution*? What do you know about its reaction and controversy on 'state' and 'states'?
5. Discuss the first phase of *Language Movement*.
6. What was the background of *six point programme*? Discuss the six points and its significance.

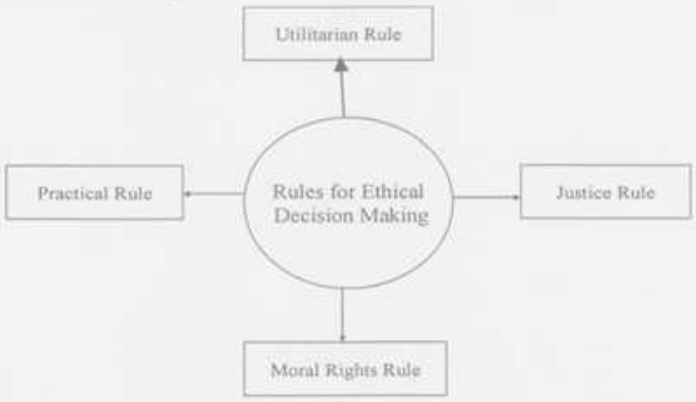
3-2

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2014
Program: B.Sc. Engineering (Civil)

Course Title: Principles of Management | Course Code: IMG 301
Time: 2 Hour | Full Marks: 50

Answer Question No. 1 and any 5 Questions from the rest

1	Write short notes on: (a) Informal and Formal Planning (b) Objective, Strategy and Tactics (c) Vision and Mission (d) At least two strength, weakness, opportunity and threat (SWOT) of Biman Bangladesh Airlines (e) Manager Vs Leader	(2x5)	10
2(a)	What are the key elements for motivation?		2
(b)	Write down the 10 methods for motivating employees in an organization.		2
(c)	Briefly describe Maslow's motivation theory with graphical representation.		4
3(a)	Write down the difference between Power and Authority.		2.5
(b)	Which type of power you think most dominant in the society? Why?		2.5
(c)	Briefly describe 3 types of authority that is stated by Max Weber.		3
4(a)	Describe the qualities of a Leader in view of management aspects.		3
(b)	What are the 3 common traits found among many leaders?		3
(c)	When Free-Rein Leadership style is appropriate?		2
5(a)	Why an organization needs control?		2.5
(b)	What should be the criteria of a good control system?		2.5
(c)	Briefly describe 3 types of control with practical example.		3
6(a)	What is meant by Time Management?		2
(b)	What are the building blocks of Time Management? Describe any one of them with practical example.		1+3
(c)	Mentioned at least 4 time wasters		2
7(a)	Write down the importance of ethics.		2
(b)	What are the common misconducts in an Organization?		2
(c)	From the following figure, briefly describe 4 types of ethical decision making rules with examples.		4



University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring - 2014
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. - The figures in the margin indicate full marks. There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". Answer from both sections according to the instruction mentioned in each section.]*

SECTION A

There are **FOUR** questions. Answer any **THREE**

Q1. (a) State and prove Rolle's theorem. 12.5

(b) Verify Rolle's theorem for $f(x)=\frac{x}{2}-\sqrt{x}$ on [0, 4]. 12.5

Q2. (a) State and prove Cauchy's Mean value theorem (MVT). 12.5

(b) Verify this theorem for $f(x)=x^3+x-4$ and $g(x)=x^2+x+2$ on the interval [-1, 2]. 12.5

Q3. (a) State and prove Lagrange's Mean value theorem (MVT). 12.5

(b) Verify this theorem for $f(x)=x^2+x+1$ on the interval [1, 2]. 12.5

Q4. (a) Let $f(x)=x^3-3x^2+1$. Find the intervals on which the function $f(x)$ is increasing, decreasing, concave up and concave down. 12.5

(b) Define relative extrema. Find the relative extrema of $f(x)=2x^2-x^4$. 12.5

SECTION B

There are **FOUR** questions. Answer any **THREE**

Q5. (a) State Taylor's theorem with remainder. Use Taylor's theorem to expand $f(x)=\ln x$ in powers of x with the remainder term. 12.5

(b) State and prove L'Hospital's rule. Apply this rule to evaluate 12.5

$$\lim_{x\to 1}\left(\frac{x}{x-1}-\frac{1}{\ln x}\right).$$

Q6. Integrate the following: 25

(i) $\int\frac{dx}{5+4\cos x}$ (ii) $\int\frac{dx}{\left(e^x+e^{-x}\right)^2}$ (iii) $\int\frac{e^x+e^{-x}}{e^x-e^{-x}}dx$ (iv) $\int\frac{dx}{x^2+2x+2}$

Q7. (a) State the fundamental theorem of calculus. 3

(b) Define reduction formula. Find a reduction formula for $\int \sin^n x\, dx$. Hence evaluate $\int \sin^3 x\, dx$. 12

(c) Evaluate $\int_0^{\frac{\pi}{2}} \frac{dx}{3+2\cos x}$ 10

Q8. (a) Find the area of the region enclosed by the curves $y^2 = 4x$ and $x^2 = 4y$. 12.5

(b) Find the area of the region enclosed by the curves $y = \sin x$ cut off by the line $y = \cos x$ from $x = 0$ to $x = 2\pi$. 12.5

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring - 2014
Program: B.Sc. Engineering (Civil, 1st year/ 2nd semester)

Course Title: Mathematics II | Course Code: MTH 103
Time: 3 hours | Full Marks: 150

*[N.B. - The figures in the margin indicate full marks. There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". Answer from both sections according to the instruction mentioned in each section.]*

SECTION A

There are **FOUR** questions. Answer any **THREE**

1. (a) Find the distance of the point $(-1,-5,-10)$ from the point of intersection of the line $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-2}{12}$ and the plane $x-y+z=5$. 12

   (b) Determine the constant k, so that the planes $x-2y+kz=0$ and $2x+5y-z=0$ are at right angles, and find in that case the plane through the point $(1,-1,-1)$ and perpendicular to both the given planes. 13

2. (a) Find the equation to the sphere which passes through the points $(0,0,0),(0,1,-1),(-1,2,0)$ and $(1,2,3)$. 12

   (b) Find the equation of the sphere which passes through the circle 13
   $$x^2+y^2+z^2-2x+2y+4z-3=0, 2x+y+z-4=0$$
   and touches the plane $3x+4y-14=0$.

3. (a) A tangent plane to the ellipsoid 12
   $$\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$$
   meets the co-ordinate axes in points P,Q and R. Prove the centroid of the triangle PQR lies on the locus of
   $$\frac{a^2}{x^2}+\frac{b^2}{y^2}+\frac{c^2}{z^2}=9.$$

   (b) Find the equation to the two planes which contain the line given by $7x+10y-30=0, 5y-3z=0$ and touches the ellipsoid $7x^2+5y^2+3z^2=60$. 13

4. (a) Show that if the origin be shifted to the point (α,β,γ); the axes remaining parallel to their original direction, then the equation of any surface is obtained by writing 15
   $$x=x'+\alpha, y=y'+\beta \text{ and } z=z'+\gamma.$$

   (b) OA, OB, OC are three mutually perpendicular lines through the origin with direction cosines $l_1,m_1,n_1;\ l_2,m_2,n_2;\ l_3,m_3,n_3$ and if $OA=OB=OC=a$, then show that the equation of the plane ABC is 10
   $$(l_1+l_2+l_3)x+(m_1+m_2+m_3)y+(n_1+n_2+n_3)z=a.$$

SECTION B

There are **FOUR** questions. Answer any **THREE**

5. (a) Define vector product of two vectors. Also discuss the geometrical interpretation of vector product of two vectors. 15

   (b) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$. 10

6. (a) Define the directional derivative of a scalar function $\varphi(x, y, z)$. Find the directional derivative of $\varphi(x, y, z) = x^2yz + 4xz^2$ at $(1, -2, -1)$ in the direction $2\boldsymbol{i} - \boldsymbol{j} - 2\boldsymbol{k}$. 15

   (b) Prove the law of sines in plane triangles using the concept of vectors. 10

7. (a) If $\varphi(x, y, z) = 2x^3y^2z^4$ then find **div grad** φ. 5

   (b) If $\underline{r} = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$ then prove that 15

   $$\nabla^2\left(\frac{1}{r}\right) = 0 \; and \; \nabla.\left(\frac{\underline{r}}{r^3}\right) = 0.$$

   (c) If $\vec{A} = xz^3\boldsymbol{i} - 2x^2yz\boldsymbol{j} + 2yz^4\boldsymbol{k}$ then find **curl curl** $\vec{A}$ at the point $(1, -1, 1)$. 5

8. (a) If $\boldsymbol{R}(u) = (u - u^2)\boldsymbol{i} + 2u^3\boldsymbol{j} - 3\boldsymbol{k}$ *then find* 5

   $$\int_1^2 R(u)du.$$

   (b) If $\vec{A} = (3x^2 + 6y)\boldsymbol{i} - 14yz\boldsymbol{j} + 20xz^2\boldsymbol{k}$, evaluate $\int_C \vec{A}.d\vec{r}$ 20

   from $(0,0,0)$ *to* $(1,1,1)$ along the following paths C:

   (i) $x = t, y = t^2, z = t^3$.

   (ii) the straight lines from $(0,0,0)$ to $(1,0,0)$, then to $(1,1,0)$ and then to $(1,1,1)$.

   (iii) the straight line joining $(0,0,0)$ and $(1,1,1)$.

The End

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring - 2014
Program: B.Sc. Engineering (Civil, 2nd year/ 1st semester)

Course Title: Mathematics III | Course Code: MTH 201
Time: 3 hours | Full Marks: 150

*[N.B. - The figures in the margin indicate full marks. There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". Answer from both sections according to the instruction mentioned in each section.]*

Section- A

Answer any 3 (Three) of the following questions:

1. **(a)** Define basis and dimension of a vector space. Write down the standard basis and dimension of R^4, P_4 and $M_{4\times4}$. **12**

(b) Let W be the subspace of R^5 spanned by the vectors $(1,-2,0,0,3)$ $(2,-5,-3,-2,6)$, $(0,5,15,10,0)$ and $(2,6,18,8,6)$. Find a basis and dimension of W. **13**

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 linear transformation. Determine which of the following mapping is linear or not. **10**

(i) $T: R^3\to R^2$ is defined by $T(x,y,z)=(y,x+z)$.

(ii) $T: R^3\to R^2$ is defined by $T(x,y,z)=(x-y-z,2)$.

(b) 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**

4. **(a)** Define eigenvalues and eigenvectors and write the characteristic equation of a matrix. Determine the eigenvalues and associated eigenvectors of the matrix **15**

$$A=\begin{pmatrix}1 & 2 & 2\\ 1 & 2 & -1\\ -1 & 1 & 4\end{pmatrix}$$

(b) Let S and T be the linear operators of R^2 into R^2 defined by $S(u,v)=(3u+2v,-6u+v)$ and $T(u,v)=(2u+v,u-v)$. Find **(i)** $(ST)(u,v)$ **(ii)** $S^2(u,v)$ **10**

Section- B

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. **13**

Mass in Kg	60-62	63-65	66-68	69-71	72-74
No. of students	5	18	42	27	8

(b) From the following data of age of employees, calculate coefficient of skewness and comment on the result: **12**

Age below (yrs)	25	30	35	40	45	50	55
No. of employees	8	20	40	65	80	92	100

7. (a) The following table gives the age and blood pressure of 10 patients: **15**

Age (yrs)	56	42	36	47	49	42	60	72	63	55
Pressure	147	125	118	128	145	140	155	160	149	150

Compute the coefficient of correlation between the age and blood pressure.

(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? **10**

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-2014
Program: B. Sc. Engineering (Civil, 2nd year/ 2nd semester)

Course Code: MTH 203 Course Title: Mathematics IV Credit: 3.00
Full Marks: 150 Time: 3(Three) hours

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

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

1. (a) Find $\mathcal{L}^{-1}\{\frac{1}{(s+a)(s+b)}\}$ [10]

   (b) Prove that the inverse Laplace transform of $\frac{1}{s^3(s^2+1)}$ is $\frac{t^2}{2} + cost - 1$. [15]

2. (a) Use Convolution theorem to find $\mathcal{L}^{-1}\{\frac{1}{p(p+1)^2}\}$. [15]

   (b) Evaluate $\mathcal{L}^{-1}\{\frac{(s+1)e^{-\pi s}}{s^2+s+1}\}$. [10]

3. A beam which is hinged at its ends $x = 0$ and $x = l$ carries uniform load W_0 per unit length. [25]

   Find the deflection at any point.

4. (a) Find the finite cosine transform of $(1 - \frac{x}{\pi})^2$. [13]

   (b) Obtain the finite Fourier sine transform of $f(x) = x^2, 0 < x < 4$. [12]

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

5. (a) Solve the following exact differential equation [15]
   $(2xsiny + y^3e^x)dx + (x^2cosy + 3y^2e^x)dy = 0$.

   (b) Obtain the solution of [10]
   $xsinydx + (x^2 + 1)cosydy = 0$.

6. (a) Test whether the differential equation $(x^2 - 3y^2)dx + 2xydy = 0$ is homogeneous or not. And hence find its solution. [15]

   (b) Determine the solution of [10]
   $(x-4)y^4dx - x^5(y-y^3)dy = 0$.

7. (a) Solve the given ordinary differential equation [20]
   $\frac{dy}{dx} + (\frac{2x+1}{x})y = e^{-x}$.

   (b) Find the general solution of [5]
   $\frac{d^3y}{dx^3} - 4\left(\frac{d^2y}{dx^2}\right) - 3\frac{dy}{dx} + 18y = 0$.

8. Obtain the general solution of [25]
   $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = x^2e^x$.

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination Spring – 2014
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 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**

1. (a) Derive an expression for the Doppler effect in sound when observer is at rest and source is in motion. **[15]**

   (b) Two trains traveling in the opposite direction at *100 km/hr* each, cross each other while one of them is whistling. If the frequency of the note is *800 Hz*, find the apparent pitch as heard by an observer in the other train: **[10]**
   (i) before the trains cross each other
   (ii) after the trains have crossed each other
   Consider the velocity of sound as 340 m/s.

2. Derive that the relation of Newton's formula for the velocity of sound in gas can be given by the relation $V = \sqrt{\frac{P}{\rho}}$. Discuss about how Laplace made correction to Newton's formula and prove that the equation of Laplace's correction to Newton's formula for velocity of sound in gas can be written as $V = \sqrt{\frac{\gamma P}{\rho}}$. **[10+15]**

   Where P is pressure and ρ is density of the gas.

3. Discuss about various types of harmonic oscillator. Show that the total energy of the simple harmonic oscillator can be written as **[10+15]**

$$E = \frac{1}{2}kA^2$$

   where E is the total energy and A is the amplitude of the simple harmonic oscillator.

4. What do you understand by simple harmonic motion? Prove that the differential equation of a progressive wave is given by **[10+15]**

$$\frac{d^2y}{dt^2} = v^2\frac{d^2y}{dx^2}$$

   where v is the velocity and y is the displacement of the wave.

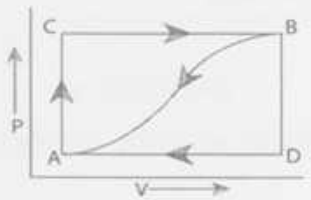
[Turn over

SECTION B

There are **FOUR** questions. Answer any **THREE**

5. (a) State and explain the laws: Zeroth law of thermodynamics, First law of thermodynamics, Second law of thermodynamics. [15]

(b) When a system is taken from the state *A* to state *B* along the path *ACB*, *80* joules of heat flows into the system and the system does *30* joules of work (fig. below). [10]



(i) How much heat flows into the system along the path *ADB*, if the work done is *10* joules?

(ii) The system is returned from the state *B* to the state *A* along the curved path. The work done on the system is *20* joules. Does the system absorb or liberate heat and how much?

(iii) If $U_A = 0$, $U_D = 40$ joules, find the heat absorbed in the process *AD* and *DB*.

6. Describe the construction and principle underlying the working of constant volume air thermometer and show that the temperature can be measured by the following equation [25]

$$t = \left(\frac{h_t - h_0}{h_{100} - h_0}\right) \times 100$$

7. What do you understand by specific heat of gas? Discuss about different types of specific heat and derive that the difference between the two principle specific heats of a gas can be written as [10+15]

$$C_p - C_v = R$$

Where C_p and C_v are the specific heat at constant pressure and constant volume respectively.

8. What is Carnot's cycle? Discuss briefly about the various processes in the Carnot's cycle and prove that the efficiency of the Carnot's engine in terms of temperature is given by the relation [10+15]

$$\eta = 1 - \frac{T_2}{T_1}$$

Where T_1 and T_2 are the temperatures of source and sink respectively.