The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B. Sc. Engineering (Civil)

Course Title: Principles of Accounting Course Code: ACN 301 Credit: 2.0

Time: 2 hours Full Marks: 50

(There are **Six questions**. Answer **Question No. 5 and any Three from the rest**. Marks of each question are shown in the right margin)

1. (a) Define Accounting. Explain the Double Entry Principles. *05*
   (b) What do you mean by Accounting Cycle? Show the Accounting Cycle in a diagram. *05*

2. (a) What is Cost Classification? Why Costs are Classified? *05*
   (b) Explain the behavioral classification of cost. *05*

3. Z-Ltd. produces and sells essential parts of Computers.
   The production, costs, and sales information for 2007 are given below. *10*

Production in units	30,000
Sales in Taka	25,00,000
Selling price per unit	100
Costs:	Taka
Raw materials purchased	6,00,000
Advertising	75,000
Entertainment and travel	40,000
Direct labor	2,50,000
Indirect labor	1,50,000
Building rent (Factory)	1,30,000
Utilities factory	1,70,000
Royalty paid for use of production patent, Tk. 5.00 per unit produced	?
Office Rent	80,000
Maintenance, factory	1,20,000
Rent for special production equipment Tk. 10,000 per year plus Tk. 2.00 per unit produced	?
Selling and administrative salaries	2,20,000
Other factory overhead costs	30,000
Other selling and administrative expenses	40,000

Inventories:	Beginning of the year	End of the Year
Raw materials	Tk. 60,000	Tk. 70,000
Work in process	Tk. 30,000	Tk. 50,000
Finished goods	0	?

You are required to prepare:
a) A schedule of cost of goods manufactured.
b) Income statement for the year 2007.

4. (a) What do you mean by Break-Even point? *02*
(b) The following information is taken from the records of a Company. *08*

	Period-1	Period-2
Sales	Tk. 45,000	Tk. 65,000
Profit	Tk. (5,000)	Tk. 5,000

You are required to calculate:
(a) P/V ratio
(b) Break Even Point in taka and margin of safety.
(c) Profit or Loss when sales amounted to Tk. 60,000.
(d) Sales required to earn a profit of Tk. 10,000.

5. The following balances has been extracted from the books of B Ltd. *20*

B Ltd.
Trial Balance
December 31, 2007

Heads of Accounts	Debits (Tk)	Credits (Tk)
Cash	36,000	
Accounts receivable	78,000	
Merchandise inventory	1,40,000	
Sales supplies on hand	2,680	
Prepaid fire insurance	2,400	
Prepaid rent	28,800	
Store equipment	60,000	
Accumulated depreciation store equipment		12,000
Accounts payable		54,600
B Capital		2,15,060
Sales		5,61,360
Sales returns and allowances	2,600	
Purchase	2,50,400	
Purchase returns and allowances		2,020
Transportation in	3,920	
Advertisement expenses	39,000	
Sales salaries expense	69,200	
General office expense	4,940	
Office salaries expense	1,20,000	
Legal and audit fees	5,000	
Telephone expense	2,400	
Interest	700	1000
Total =	8,46,040	8,46,040

Additional data as of December 31, 2007

1. Prepaid fire insurance expired Tk. 1,000
2. Sales supplies consumed Tk. 1,500
3. Prepaid rent expired during the year Tk. 22,000
4. Depreciation expense on store equipment 6,000
5. Accrued sales salaries Tk. 4,000
6. Accrued office salaries Tk. 5,000
7. Merchandise inventory on hand 31 December, 2007. Tk. 185,000.

Prepare a) Classified Income Statement, b) Classified Balance Sheet.

6. (a) Distinguish between Marginal costing Technique and Absorption costing Technique. *02*

(b) Product 'A' can be produced either by machine 'X' or by Machine 'Y'. Machine 'X' can produce 10 units of 'A' per hour and 'Y' cam produce 15 units per hour. Total Machine hours available are 3000 hours per year. Taking into account the following comparative costs and selling price, determine the profitable method of manufacture: *08*

Per Unit of Product A

	Machine 'X'	Machine 'Y'
	Tk.	Tk.
Direct Material	20	20
Direct Labor	10	13
Overhead:		
Variable	12	14
Fixed	3	3
Total cost	45	50
Selling Price	60	60

THE UNIVERSITY OF ASIA PACIFIC
Department of Civil Engineering
Repeat Examination Fall-2007
Program : B.Sc Engineering (Civil)

Course Title: Principles of Accounting: Course Code: ACN– 301: Credit -2

Time: 2 hours Full Marks - 50

(There are six questions. Answer question no. 5 and any three from the rest. Marks of each question are shown in the right margin)

1. (a) Define Accounting. Explain the Accounting Process. 05
   (b) What do you mean by Double Entry Principle? State the rules of Debit and Credit. 05

2. (a) What is Cost Classification? Why Costs are Classified? 05
   (b) Explain the behavioral classification of cost? 05

3. Y - Ltd. Produces a single product. Various cost and sales data of 'Y' Ltd. For the just completed year is given below : 10

Production in units	30,000
Sales	Tk. 14,30,000
Selling price per unit	Tk. 55
Costs:	Taka
Raw materials purchased	4,80,000
Advertising Expenses	1.10,000
Entertainment and travel	45,000
Direct labor	98,000
Indirect labor	85,000
Building rent (Production uses 80% of the space; administrative and sales offices use the rest)	40,000
Utilities factory	1,08,000
Royalty paid for use of production patent, Tk. 1.5 per unit produced	?
Maintenance, factory	16,800
Rent for special production equipment Tk. 7,000 per year plus Tk. 0.30 per unit produced	?
Selling and administrative salaries	2,20,000
Other factory overhead costs	19,200
Other selling and administrative expenses	20,000

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

You are required to prepare :
a) A schedule of cost of goods manufactured.
b) Income statement for the year 2007.

4. (a) What do you mean by C-V-P Analysis ? 02
   (b) The following information is taken from the records of a Company. 08

Period	Sales (Tk.)	Profit (Tk.)
Period-1	80,000	10,000
Period-2	90,000	14,000

You are required to calculate:

i. P/V ratio
ii. Break Even Point in taka and margin of safety.
iii. Profit or Loss when sales amounted to Tk. 50,000.
iv. Sales required to earn a profit of Tk. 19,000.

5. The 'Z' company sales printing equipment to customers. The ending inventory on hand at June 30, 2007 had a cost of Tk. 30,000. The Trial Balance of the company is shown below : 20

Heads of Accounts	**Debits (Tk)**	**Credits(Tk)**
Cash	10,000	
Accounts receivable	35,000	
Merchandise inventory	22,000	
Sales supplies on hand	5,000	
Prepaid fire insurance	1,000	
Land	42,000	
Office equipment	40,000	
Accounts payable		40,000
Capital		1,01,000
Sales		2,05,000
Sales Discount	3,500	
Sales returns and allowances	2,800	
Purchase	1,12,000	
Purchase returns and allowances		2,000
Purchase Discount		2,000
Heat & light expenses (selling)	2,000	
Sales salaries expense	30,000	
General selling expenses	2,000	
General office expense	5,000	
Office salaries expense	20,000	
Delivery expenses	4,000	
Telephone expense	2,500	
Rent expenses (Office)	5,000	
Rent expenses (Selling)	6,000	
Interest	1,200	1000
Total =	3,51,000	3,51,000

Additional data as of June 30, 2007

1. Prepaid fire insurance expired Tk. 500
2. Sales supplies consumed Tk. 2,500
3. Depreciation on office equipment Tk. 4,000
4. Accrued sales salaries Tk. 5,000
5. Accrued office salaries Tk. 4,500

Prepare a) Classified Income Statement. b) Classified Balance Sheet.

6. (a) Distinguish between Marginal costing Technique and Absorption costing Technique. 02

(b) Product 'A' can be produced either by machine 'X' or by Machine 'Y'. Machine 'X' can produce 10 units of 'A' per hour and Y – 15 units per hour. Total Machine hours available are 3000 hours per year. Taking into account the following comparative costs and selling price, determine the profitable method of manufacture : 08

Per Unit of Product A

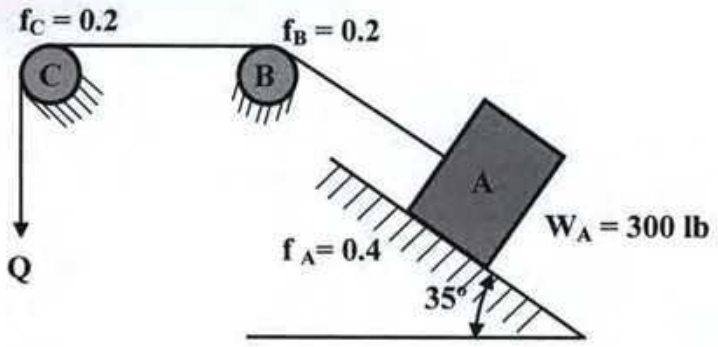
	Machine 'X'	Machine 'Y'
	Tk.	Tk.
Direct Material	20	20
Direct Labor	10	14
Overhead :		
Variable -	12	15
Fixed	3	3
Total cost	45	52
Selling Price -	60	60

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007

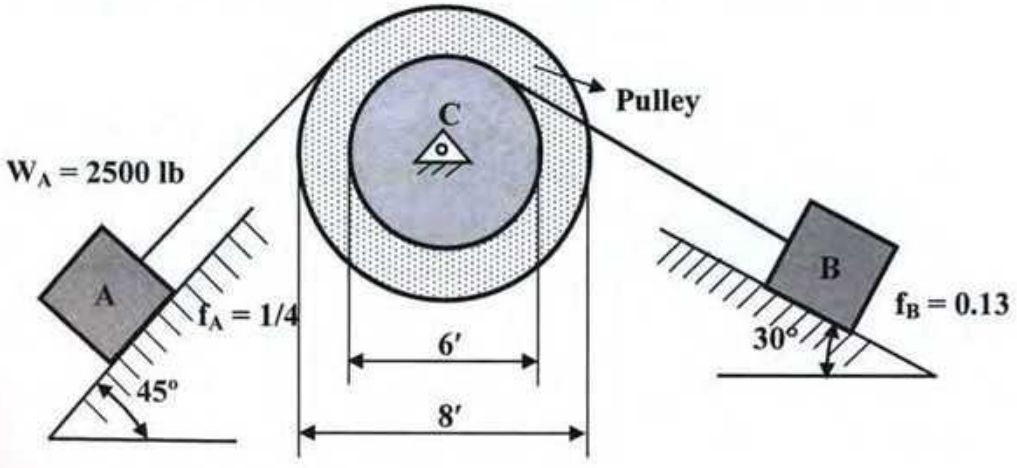
Course No: CE 103 — Course Title: Engineering Mechanics II
Full Marks: 150 — Time: 3.0 hours

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

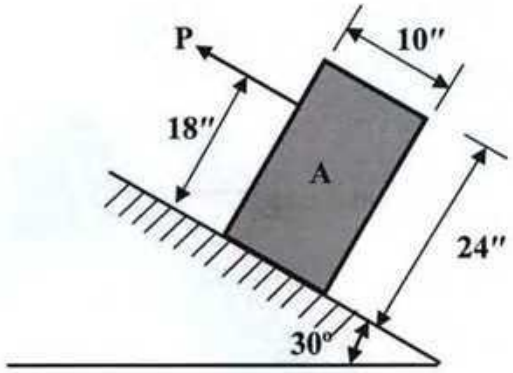
1.(a) For the figure shown below, what is the value of **Q**, when the block **A** will impend to slide upward? **(12)**



(b) In the following figure, for impending anticlockwise motion of the pulley, what is the weight of the body **B**? The bearing at **C** is smooth. **(13)**



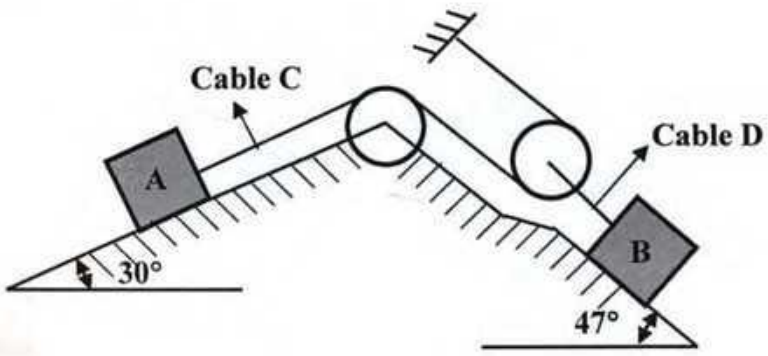
2.(a) In the following figure, $W_A = 200$ lb, $f = 0.4$. The body will be acted upon by a gradually increasing force **P**. Will the body slide or tip over? **(13)**



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

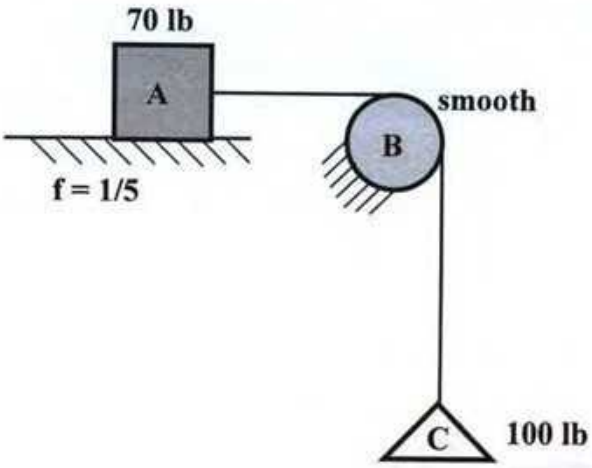
3.(a) A rotating body follows the law $\theta = 4t^3+3t^2+25$ rad, where t is in seconds. Determine the angular displacement, velocity and acceleration after 10 sec. Is the acceleration constant? **(10)**

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



4.(a) A point **P** moves in the path of the hyperbola $x^2/36 - y^2/16 = 1$. The x component of the velocity is constant at 10 fps. At the instant when **P** is at the position $(12, 4\sqrt{3})$, what are the accelerations in x and y directions? What is the tangential velocity? **(12)**

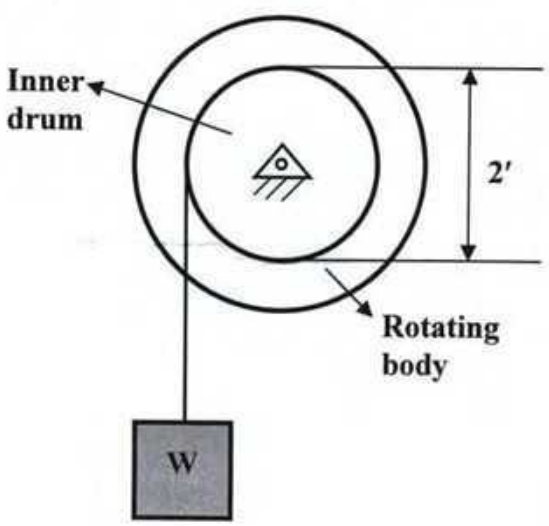
(b) Refer to the following figure, the initial velocity of A is 28 fps towards the right, find the time in seconds for A to travel 15 ft. **(13)**



5.(a) In the following figure, the rotating assembly weighs 250 lb, diameter and weight of the inner drum are 2 ft and 62.4 lb, respectively. Neglect friction and the mass of the cable. If **W** is released from the rest and descends 23 ft in 6 sec, find **(13)**

(i) the tension in the cable.

(ii) the radius of gyration of the rotating assembly.

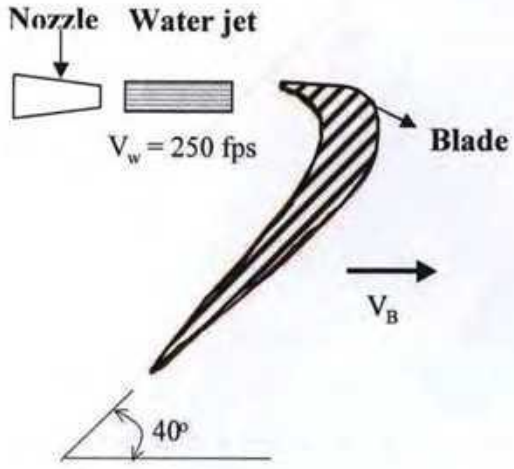


(b) A 16″ diameter solid cylinder **A** weighs 1300 lb. It rolls without slipping down a 30° incline. Its c.g. has an initial speed of 14 fps. How long it will move, before its c.g. has a speed of 40 fps? What is the force of friction between the cylinder and the plane? **(12)**

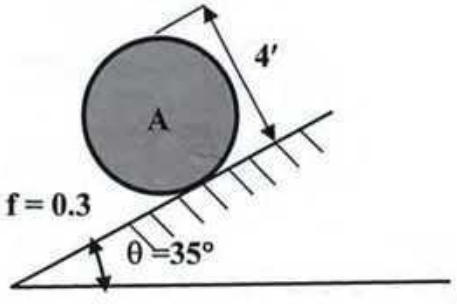
6.(a) A cylindrical jet of water from a nozzle with a velocity of 250 fps and at the absolute rate of 6 lb per sec enters a blade as shown in the following figure. Neglecting the frictional loss, determine the resultant force on the blade in magnitude and direction for the following conditions: **(15)**

(i) when velocity of the blade, $V_B = 0$ fps

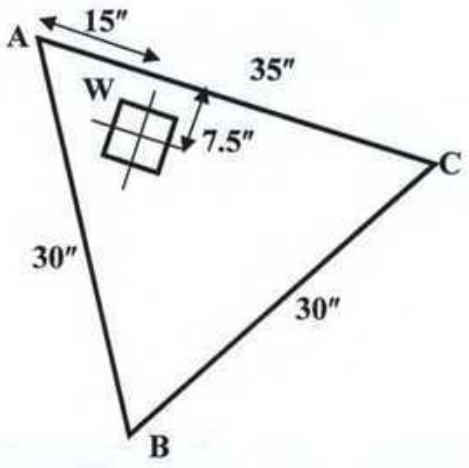
(ii) when velocity of the blade, $V_B = 90$ fps



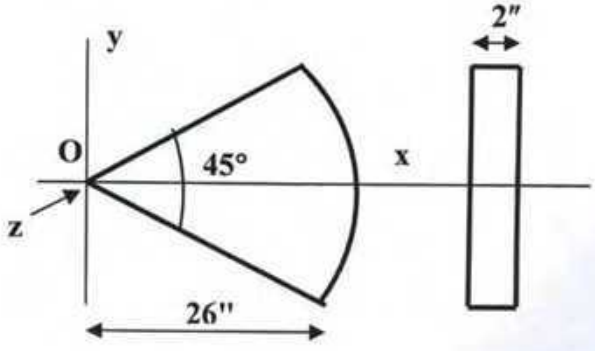
(b) Refer to the following figure, a 4 ft cylinder **A**, weighing 950 lb, rolls down a 35° incline from rest. What is the speed of the cylinder after it has rolled 45 ft? **(10)**



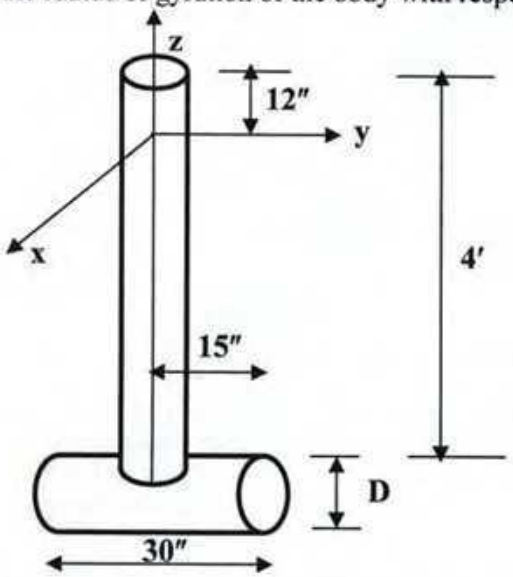
7.(a) As shown in the following figure, the weight W = 95 lb is placed on a triangular table. Find the reactions at supports **A**, **B** and **C**. **(13)**



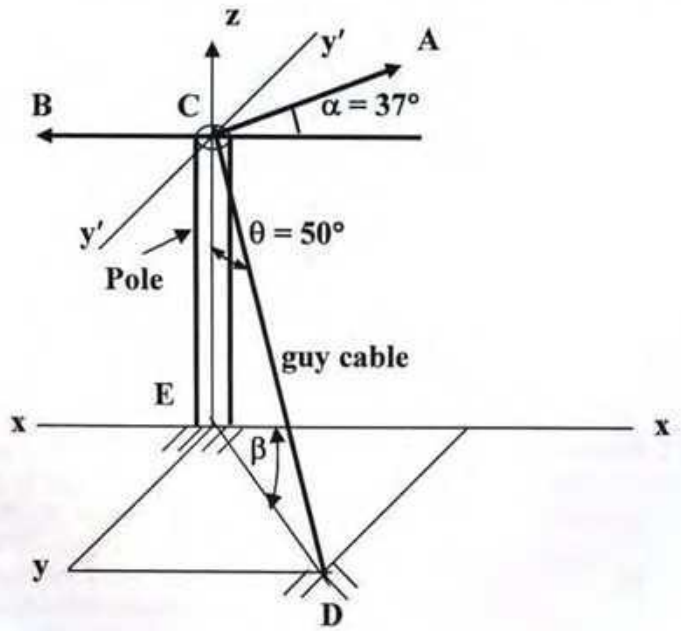
(b) A 45° sector of a cast iron disk with a radius of 26″ is used to balance the reciprocating part of a certain engine as shown in the following figure. Find the mass moment of inertia about the **z** axis. Unit weight of cast iron is 450 lb/cft. **(12)**



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



(b) Two cables A and B terminate on a pole as shown in the following figure and exert forces in the horizontal plane at C. The guy cable CD makes an angle with the pole of 50° and the anchor at D is to be so located that the pole will have only a compressive load. Let α = 37°, A = 6000 lb, B = 9000 lb and CE = 30′. Find the value of angle β, the tension in the cable CD and the compressive force acting on the pole. **(12)**



The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B.Sc Engineering (Civil)

Course # CE 105 | Course Title: Surveying
Full Marks: 150 | Time : 3 hrs

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

SECTION A

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

1. (a) What factors should be considered for deciding the stations of a chain survey? (7)
   (b) Write short note on Magnetic Declination. (6)
   (c) A rectangular plot EFGH forms the plane of a pit cut for construction work. B is point of intersection of the diagonals. Calculate the volume of the excavation in cubic meters from the following data: (12)

Point	E	F	G	H	B
Original level	46.3	49.5	52	47.2	52.2
Final Level	38.6	40.8	42.7	41.6	43

Length of two sides of rectangle is 52 m and 85 m, respectively.

2. (a) Explain the "closing error" of a compass survey. Show how you can adjust it by graphical method. (8)
   (b) For the following traverse, find the length of DE so that A,E and F may be in the same straight line: (12)

Side	Length (ft)	W.C.B
AB	200	S 84^0 30'E
BC	100	N 75^0 18' E
CD	80	N 18^0 45'F
DE	-	N 29^0 45' E
EF	150	N 64^0 10'E

   (c) What are the advantages and disadvantages of plane table surveying? (5)

3. (a) What are the instruments used in chaining? (3)
   (b) Write short notes on : (i) Bench mark (ii) Mean sea level (7)
   (c) An instrument was setup at P and the angle of elevation to a vane 2 m above the foot of the staff held at Q was 6^0 30'. The horizontal distance between P and Q was known to be 4000 m. Determine the reduced level of the staff at station Q. Given that the R.L of the instrument axis was 2550.38 m (10)
   (d) The length of a line measured with a 20- meter chain was found to be 260 meters. Calculate the true length of the line if the chain was 10 cm too long. (5)

4. (a) Discuss any one method of interpolating the contours. (8)
(b) Discuss in brief the classification of surveying based on the object of the field survey. (5)
(c) The following readings have been taken from the page of an old level book. (12)
Reconstruct the page. Fill up the missing quantities and apply the usual checks.

Station	B.S.	I.S.	F.S.	Rise	Fall	R.L	Remarks
1	3.125					X	B.M
2	X		X	1.325		125.005	T.P
3		2.320			0.055		
4		X				125.350	
5	X		2.655				T.P
6	1.620		3.205		2.165		T.P
7		3.625					
8			X			122.590	

SECTION B

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

5.(a) Why are circular curves required? For a simple curve, define (i) Tangent distance, (ii) Deflection angle, (iii) Back tangent and (iv) Long chord. (5)

(b) Two tangents intersect at chainage 83+70, the deflection angle being 52° 26'. Calculate the necessary data for setting out a curve of 25 chains 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 meters (100 links). (12)

(c) A transition curve is required for a circular curve of 250 meters radius, the gauge being 2.5 meters and maximum super-elevation restricted to 150 mm. The transition curve is to be designed for a velocity such that no lateral pressure is imposed on the rails and the rate of gain of radial acceleration is 25 cm/sec^3. Calculate the required length of the transition curve and the design speed. (8)

6.(a) What is transition curve? Why is it provided? What is super-elevation? (5)

(b) A road bend, which deflects 85°, is to be designed for a maximum speed of 94 km/hr, a maximum centrifugal ratio of 1/3 and a maximum rate to the change of acceleration of 30 cm/sec^2 .The curve consists of a circular arc in combination with two cubic spirals. Calculate- (20)

(i) Radius of the circular arc.
(ii) The requisite length of transition curve.
(iii) The total length of the composite curve.
(iv) The chainage of the beginning and end of transition curve and of the junctions of the transition curves with the circular arc if the chainage of the P.I is 45268 meters.

7.(a) Define (i) Celestial poles and Celestial Equator (ii) Celestial Horizon (iii) Zenith and Nadir. (5)

(b) Calculate the distance in kilometers between two points A and B along the parallel of latitude, where (5)

(i) Latitude of A = 22° 63′ S , Longitude of A = 120° 36′ W

(ii) Latitude of B = 22° 63′ S , Longitude of B = 150° 42′ E

(c) Find the shortest distance between two places A and B, given that the latitude of A and B are 25° 0′ N and 130° 23′ N and their longitudes are 55° 0′ E and 56° 21′ E respectively. (10)

(d) Calculate the LMT corresponding to the GMT of 10hr 35min 10sec at a place in the longitude of 70° 5′ W. (5)

8.(a) What are forward overlap and sidelap in aerial photography? What are the reasons for overlapping? (5)

(b) A camera having focal length of 25 cm is used to take a vertical photograph of a terrain having an average elevation of 1000 meters. What is the height above mean sea level at which an aircraft must fly in order to get the photograph at a scale of 1: 7000? (5)

(c) An aircraft has been planned to fly over a defined territory to prepare a map of that area. The flying height has been adjusted to a height of 150 m from water surface. Again the elevation of the ground surface is 200m relative to a predefined datum. The territory covers an area of 10 km x 13.5 km. The scale of the photograph is 1 cm =350m. The photograph size is 15 cm x 15 cm. Determine the number of photographs to cover the area, if the desired overlap is 67% and the side lap is 25%. (15)

Given formula:

$T = R \tan(\Delta / 2)$

$l = (\pi R \Delta) / 180$

$L = v^3 / (\alpha R)$

$\tan\theta = v^2 / (g R)$

$\Delta s = L / (2R) = 1719 (L / R)$

$s = L^2 / (24R)$

$$\cos P = \frac{\cos p - \cos a * \cos b}{\sin a * \sin b}$$

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

$$\tan (A - B)/2 = \frac{\sin (a - b)/2}{\sin (a + b)/2} \cot (P/2)$$

Note: Here the symbols have their usual meanings.

PARKING AND TRAFFIC REGULATION STANDARD

Approaching road:

Normal car : Minimum 3.0 m for one way and 5.5 m for two way

Bus & Truck : Minimum 4.5 m for one way and 6.5 m for two way

Minimum parking space dimensions:

Car Type	Parking width	Parking Length	Area
Car	2.4 m	4.8m	11.52 sqm
Bus & Truck	3.6 m	10.0m	360 sqm

Ramp: Minimum slope 1:8.

MINIMUM PARKING REQUIREMENTS

Occupancy Type	Building Type	Minimum Parking Requirements
Residential buildings	**Type A**	
Single Family		1 Car parking
Single Family with gross floor area exceeding 200 sqm		2 Car parking
Flats with gross floor area exceeding 200 sqm		1 Car parking for each unit
Flats with a gross floor area of 140 sqm to less than 200 sqm		2 Car parking for every 3 units
Flats with a gross floor area of 90 sqm to less than 140 sqm		1 Car parking for every 2 units
Flats with a gross floor area of 60 sqm to less than 90 sqm		1 Car parking for every 4 units
Flats with a gross floor area of less than 60 sqm		1 Car parking for every 8 units
Flats with a gross floor area of less than 90 sqm (in addition to car park)		1 motorbike parking for every 5 units
Hotels(Star Class)		1 Car parking for 5 guest rooms
Hotels(Other type)		1 Car parking for 200sqm gross areas
Educational (Schools, High schools)	**Type B**	1 Car parking for 100sqm gross floor area
Training centres; Private universities		1 Car parking for 150sqm gross floor area
Others		1 Car parking for 250sqm gross floor area
Institutional Buildings	**Type C**	
Health Care (Hospitals, Clinics)	**Type D**	1 Car parking for every 5 beds
Assembly Buildings	**Type E**	
Theatre, Auditorium		1 Car parking for every 40 seats
Wedding, Party Centres		1 Car parking for each 15 sqm of gross area
Commercial buildings	**Type F**	
Shops, Departmental stores, offices		1 Car parking for each 100 sqm of gross area
Restaurants		1 Car parking for each 20 sqm of gross area
Industries	**Type G**	1 Car parking for each 500 sqm of gross area
Storage Buildings	**Type H**	1 truck parking for loading and unloading

পিডব্লিউডি এর দালান নির্মাণের নতুন হার

[২৩ শে অক্টোবর ২২তে কার্যকর]

	PW PLAR 2006 Foundation up to Plinth: Taka per sqm													
	Sub-Structure : Cost in Tk. (for fc = 2 MPa, min fcr = 30 MPa, reduction by for 15% fc = 10 to 21 MPa & Add 1.5% for fc = 32 MPa & min = 37 MPa													
	Foundation cost up to PL: 1:5:3 RCC, but to add member weightage rate from MW Table													
	Sallow Foundation*1, Depth of back fill in Foundation trench up to plinth 2.50 m													
	Brick Masonry Structure : fc = 19 - 21 Mpa		Bearing Capacity							Micro pite		Pite Founda-tion		Mat *2 Founda-tion
	Non-residential Concrete with brick-chips	Residential Concrete with brick-chips	Qa=2, ksf	Qa=2.50, ksf	Qa=3.0, ksf	Qa=3.5, ksf	Qa=4, ksf	Qa=4.5, ksf	Qa=5.0, ksf	No base-ment slab	with 12 inch base-ment slab	without base-ment floor	with 12 inch base-ment slab	Not as base-ment
Storey	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm	Tk. / sqm
1	2082	2472	3982	3875	3811	3769	3740	3718	3702	2761	3904	7281	10260	4331
2	2145	2238	4684	4381	4199	4080	3997	3936	3830	3612	3716	7431	10410	8033
3	2209	2305	5591	5036	4702	4482	4329	4217	4133	4667	3733	7677	10655	7281
4	2275	2374	6566	5811	5296	4958	4723	4551	4421	5855	4970	7951	10928	8389
5	2344	2445	8001	6774	6035	5550	5212	4965	4778	7221	6284	8259	11230	9401
6			9455	7851	6862	6213	5759	5429	5178	8706	7670	8578	11542	10341
7			10961	8908	7673	6862	6296	5883	5571	10345	9120	9561	12502	11224
8				10043	8544	7560	6873	6371	5992	11856	10631	10373	13290	12061
9				11252	9471	8302	7487	6891	6441	13424	12199	11333	14226	12861
10				12529	10451	9088	8136	7441	6915	15046	13820	12156	15025	13628
11					11482	9913	8818	8019	7414	16718	15493	12995	16331	14366
12					12561	10777	9532	8623	7936	18440	17215	14779	17581	15080
13						11678	10277	9254	8480	20209	18984	15931	18700	15773
14						12614	11051	9909	9046	22023	20798	17083	19819	16445
15							11853	10588	9632	23881	22655	18355	21057	17100
16							12682	11290	10238	25780	24555	19516	22183	17739
17								12015	10863	27721	26496	21014	23648	18364
18								12761	11507	29702	28476	22194	24795	19267
19									12169	31721	30496	23375	25942	20712
20									12849	33778	32552	24953	27486	22198
21									13546	35871	34646	26153	28653	23723
22									14259	38001	36776	27528	29994	25286
23									14989	40166	38940	28736	31169	26887
24									15736	42365	41139	29944	32343	28525
25									16498	44597	43372	31451	33816	30199
26										46863	45637	32671	35002	31908
27										49161	47935	33998	36296	33652
28										51490	50265	35222	37486	35430
29										53951	52626	36446	38747	37241
30										56243	55018	37670	39867	39085
31										58665	57439	39017	41181	40962
32										61116	59891	40373	42502	42870
33										63597	62371	41736	43832	44810
34										66106	64881	43107	45170	46780
35										68544	67419	44486	46515	48781
36										71210	69985	45873	47869	50812

Note

*1 Where Back fill in foundation are not required to fill by Carted Earth or Sand Tk. 1000.00 per sqm Can be deducted from respective PLA rates of foundation.
*2 Mat Foundation Leading to Basement floor Tk. 538.00 per sqm to be deducted, but to add cost from Basement floor system Table

		Superstructure Cost (Tk.), but to Add member Weightage Rate																			
		BUILDING CATEGORY																			
		Load Bearing brick-wall system: fc = 19-23 MPa						RCC Frame Structure: fc = 19-21 MPa						RCC Frame Structure: fc = 22-25 MPa (Add 1.5% for 30 MPa Concrete)							
		NON RESIDENTIAL : NRLB A2 (Concrete brick chips)			RESIDENTIAL: RLB A2 (Concrete with brick chips)			NON RESIDENTIAL: NRRCB A2 (Concrete with brick chips)			RESIDENTIAL: RRCB A2 (Concrete with brick chips)			NON RESIDENTIAL: NRRCS C2 (Concrete with stone chips)			RESIDENTIAL : RRCS B2 (Concrete with stone chips)				
Level	Floor	Economy	Standard	Superior	Economy	Standard	Superior	Economy	Standard	Superior	Economy	Standard	Superior	Economy	Standard	Superior	Economy	Standard	Superior	Level	Floor
0	GF Park							5449	5812	6538	5634	6010	6761	5922	6317	7107	6124	6532	7349	0	GF Park
0A	F. Habitation	6980	7445	8376	7218	7699	8662	8545	9601	12674	8837	9929	13106	9020	10135	13378	9631	10792	14274	0A	F. Habitation
1	1st Floor	6732	7181	8079	6962	7426	8354	8242	9360	12224	8523	9576	12640	8699	9775	12903	9289	10409	13767	1	1st Floor
2	2nd Floor	6833	7289	8200	7066	7537	8479	8365	9399	12407	8651	9720	12830	8830	9921	13096	9568	10565	14160	2	2nd Floor
3	3rd Floor	6936	7398	8323	7172	7650	8606	8491	9540	12593	8780	9866	13023	8952	10070	13293	9855	10723	14606	3	3rd Floor
4	4th Floor	7040	7509	8448	7280	7765	8736	8618	9683	12782	89[illegible]	10014	13218	9097	10221	13492	10151	10884	15044	4	4th Floor
5	5th Floor	7145	7622	8574	7389	7881	8867	8748	9829	12974	9046	10154	13416	9233	10374	13694	10455	11046	15495	5	5th Floor
6	6th Floor							8835	9937	13104	9136	10265	13550	9326	10478	13831	11030	11158	15950	6	6th Floor
7	7th Floor													8793	9668	13026	9378	10509	13670	7	7th Floor
8	8th Floor													8849	9942	13124	9449	10587	13974	8	8th Floor
9	9th Floor													8915	10017	13222	9520	10667	14079	9	9th Floor
10	10th Floor													8982	10092	13322	9591	10747	14185	10	10th Floor
11	11th Floor													9049	10168	13422	9663	10827	14291	11	11th Floor
12	12th Floor													9117	10244	13522	9735	10909	14398	12	12th Floor
13	13th Floor													9186	10321	13624	9808	10991	14506	13	13th Floor
14	14th Floor													9254	10398	13726	9882	11073	14615	14	14th Floor
15	15th Floor													9324	10476	13829	9956	11156	14725	15	15th Floor
16	16th Floor													9394	10555	13932	10031	11240	14835	16	16th Floor
17	17th Floor													9464	10634	14037	10106	11324	14946	17	17th Floor
18	18th Floor													9535	10714	14142	10182	11409	15059	18	18th Floor
19	19th Floor													9607	10794	14248	10258	11494	15171	19	19th Floor
20	20th Floor													9727	10929	14426	10386	11638	15361	20	20th Floor
21	21st Floor													9848	11066	14607	10516	11784	15552	21	21st Floor
22	22nd Floor													9972	11204	14789	10595	11931	15745	22	22nd Floor
23	23rd Floor													10096	11344	14974	10675	12080	15944	23	23rd Floor
24	24th Floor													10222	11486	15161	10755	12231	16144	24	24th Floor
25	25th Floor													10350	11629	15351	10835	12384	16345	25	25th Floor
26	26th Floor													10480	11775	15543	10917	12539	16550	26	26th Floor
27	27th Floor													10611	11922	15737	10998	12695	16757	27	27th Floor
28	28th Floor													10743	12071	15934	11081	12854	16966	28	28th Floor
29	29th Floor													10877	12222	16133	11164	13015	17178	29	29th Floor
30	30th Floor													11013	12375	16335	11248	13178	17393	30	30th Floor
31	31st Floor													11151	12529	16539	11332	13342	17610	31	31st Floor
32	32nd Floor													11291	12686	15745	11417	13509	17830	32	32nd Floor
33	33rd Floor													11432	12845	16955	11503	13678	18053	33	33rd Floor
34	34th Floor													11575	13005	17167	11589	13849	18279	34	34th Floor
35	35th Floor													11719	13153	17381	11676	14022	18508	35	35th Floor
36	Roof Top	997	1063	1196	997	1063	1196	1071	1143	1286	1108	1182	1329	1070	1284	1695	1070	1284	1695	36	Roof Top
0	Porch	2662	2662	2662	2662	2662	2662	2862	2862	2862	2862	2862	2862	2862	2862	2862	2862	2862	2862	0	Porch

ADDITIONAL COST FOR

Saline zone, to use concrete of min f'c = 25 MPa & min fcr = 31 MPa	1%	of PLAR
Wind (other than coastal area) & earth-quake load resisting structure: to use concrete of min f'c = 21 MPa & min fcr = 2 MPa	2%	of PLAR
Coastal area: affected by cyclone & water surge: to use concrete of min f'c = 25 MPa & min fcr = 31 MPa	3%	of PLAR
Roof top RCC parapet	Tk. 953.00	per sqm
Roof-top RCC, water tank in/c beams & supports etc.	Tk. 83.00	per gallon

Internal sanitary and water supply

(i) Residential building

Economy	Tk. 475.00	per sqm
Standard	Tk. 712.00	per sqm
Superior	Tk..1068.00	per sqm

(ii) Non-residential building

Economy	Tk. 356.00	per sqm
Standard	Tk. 534.00	per sqm
Superior	Tk. 801.00	per sqm

7. Internal electrification

(i) Residential building

Economy	Tk. 1032.00	per sqm
Standard	Tk. 1289.00	per sqm
Superior	Tk. 1547.00	per sqm

(ii) Non-residential building

Economy	Tk. 774.00	per sqm
Standard	Tk. 967.00	per sqm
Superior	Tk. 1161.00	per sqm

8. Gas Connection

(i) Ground floor: Add 2.5% on the cost of civil construction in G.F.	Tk. 256.00	per sqm
(ii) Other floors: Add 1% on the cost of civil construction	Tk. 102.00	per sqm

9. External Water Supply

(i) Underground water reservoir:	Tk. 59.00	per gallon
(ii) Distribution line, water pump, pump house, WASA/Municipal charge as per requirement	Estimate	

10. External electrification:

(i) Sub-station building
(ii) Sub-station Equipment/Transformer.
(iii) Pump & motor set including installation.
(iv) H.T/LT Line
(v) PDB/DESA/REB charge
(vi) Stand by Power & Source
(vii) Earthling System
(viii) Over head Transmission Line
(ix) Under ground Cable Laying
(x) Compound light, wiring system & other safety systems.

Estimate to be prepared on the basis of requirements

11. Boundary Wall:

(i) **Boundary Wall 125 mm thick with 250 × 250 mm brick pillar:** Construction of 125 mm thick boundary wall with 250 mm × 250 mm size brick pillar @ 2.44 meter c/c, of height 1.52 meter above G.L. 0.76 m below G.L. and RCC coping of 75 mm thick and 375 mm width, 12 mm thick plaster (1:6) in both sides of the wall including the cost of reinforcement and white washing etc. — Tk. 2429.00 Per mr

(ii) **Boundary wall in RCC frame:**

Construction of RCC boundary wall of height 1.52 meter above GL and one meter below GL with column 250 mm× 250 mm size and the beam 250 × 250 mm at ground level, 75 mm thick and 375 mm thick and 375 mm width RCC coping and 125 mm (1:4) brick work in between the columns, 12 mm thick cement plaster (1:6) on the both sides of brick surface and 6 mm thick cement plaster (1: 4) on RCC, in all exposed surface on both sides of the boundary wall including the cost of MS Rod white washing etc. Tk. 3486.00 Per mm

(iii) **Barbed wire fencing over Boundary Wall:**

Supplying fitting and fixing 12 BWG barbed wire (2 ply 4 points over boundary wall @ 150 mm c/c both vertically and horizontally supported by materials, RCC work and the angle posts placed @ 2.4 meter c/c including cost of making hoses in RCC or brick column including straightening, tightening, binding the joints of barbed wire with 18 BWG wire, making holes in the angle in all respect and mending good the damages of RCC or brick column, including supply of all necessary materials. Tk. 272.00 Per mm

12. **Road Work:**

(i) **RCC Road:**

Construction of RCC road with 250 mm thick guide wall of height 0.30 meter 150 mm thick RCC work over one layer 1st class-brick flat soling and pllythene sheet including the cost of reinforcement 10 mm dia MSWK-Ó Rod 175 mm C/C in both directiiiion. Tk. 1606.00 Per sqm

(ii) **Bituminous Carpeting Road:**

Construction of 38 mm thick compacted bituminous carpeting over 75 mm thick brick flat soling with 1st class brick and herring bone bond surface with 75 mm thick end edging, 62 mm - 37 mm size brick bats khoa consolidation and compacted water bound macadam providing tack coat 07.32 kg of bitumen per 10 sqm and seal coat 07.32 kg of bitumen per 10 sqm of road surface and also providing premixed bitumen seal coat with 0.12 cum of pea gravels with 80 kg of bitumen per cum of pea gravels and laid over 10 sqm of road surface. Tk. 915.00 Per sqm

13. **Semi Permanent Structure:**

Plinth area rates for standard semi-permanent building with CI sheet roofing on metal truss, supported on brick pillars & walls in 1:4 cement sand mortar having 75 mm thick DPC, in/c earth work, back filling in foundation and plinth <= 1 m & 125 mm thick panel brick work in superstructure with 150 mm × 250 mm intermediate pillar at 2.4 m to 3 m C/C, doors and Windows made of best local timber with standard window grills, RCC work (1:2:4) in lintel, patent stone flooring (1:2:4), minimum 12 mm thick cement plaster (1:6) to both sides superstructure wall and 12 mm thick cement plaster (1:4) in plinth, steps, and dado, Aesthetically accepted low cost false ceiling, white/color washing and necessary earth work in foundation, earth and sand filling in plinth and other petty items as required and complete to function in all respect. Tk. 5971.00 Per sqm

14. **Structure constructed departmentally:**

Any construction work executed departmentally, 18% of the Total Cost to be deducted from the calculated gross cost.

সংযুক্তি-৩

সারণী ৩: FAR, ভূমি ব্যবহারের অনুপাত ও সংলগ্ন রাস্তার প্রস্থতা

ভবনসমূহ-এ অনুযায়ী ইমারতের ব্যবহারের শ্রেণী		জমির পরিমাপ																				
		১৫০ বর্গমিটার পর্যন্ত			উর্ধ্বে ১৫০ বর্গমিটার - ৩০০ বর্গমিটার			উর্ধ্বে ৩০০ বর্গমিটার - ৫০০ বর্গমিটার			উর্ধ্বে ৫০০ বর্গমিটার - ৮৫০ বর্গমিটার			উর্ধ্বে ৮৫০ বর্গমিটার - ১০০০ বর্গমিটার			উর্ধ্বে ১০০০ বর্গমিটার - ২৩০০ বর্গমিটার			২৩০০ বর্গমিটারের উর্ধ্বে		
		FAR	সর্বোচ্চ ভূমিব্যবহার (%)	সর্বনিম্ন প্রস্থ মাপ (মি.)	FAR	সর্বোচ্চ ভূমিব্যবহার (%)	সর্বনিম্ন প্রস্থ মাপ (মি.)	FAR	সর্বোচ্চ ভূমিব্যবহার (%)	সর্বনিম্ন প্রস্থ মাপ (মি.)	FAR	সর্বোচ্চ ভূমিব্যবহার (%)	সর্বনিম্ন প্রস্থ মাপ (মি.)	FAR	সর্বোচ্চ ভূমিব্যবহার (%)	সর্বনিম্ন প্রস্থ মাপ (মি.)	FAR	সর্বোচ্চ ভূমি ব্যবহার (%)	তাহার সর্বনিম্ন প্রস্থ মাপ (মি.)	FAR	সর্বোচ্চ ভূমি ব্যবহার (%)	তাহার সর্বনিম্ন প্রস্থ মাপ (মি.)
Type A : আবাসিক [১, ২]	A1- A4	২.৫	৬০	৯	৩.০	৬০	৯	৩.২৫	৬০	৯	৩.৫	৬০	৯	৪.০	৫০	৯	৪.৫	৪২	১০	৬.০	৪০	১৮
	A5	-	-	-	-	-	-	৩.৫	৬০	৯	৩.৭৫	৬০	৯	৪.২৫	৫০	৯	৫.০	৩০	১২	NRisl	৫০	১৮
Type B: শিক্ষা প্রতিষ্ঠান [৪]	B1	-	-	-	-	-	-	২.৫	৬০	৯	২.৫	৬০	৯	২.৭৫	৫০	৯	৩.৫	৩০	১২	৪.০	৫০	১৮
	B2	-	-	-			-	২.০	৫০	৯	২.০	৫০	৯	২.২৫	৫০	৯	২.৫	৩০	১২	NR	৫০	১৮
Type F: অফিস	F1	২.৫	৬৫	৯	৩.০	৬০	৯	৩.৫	৫০	১	৪.০	৬০	১	৫.০	৫০	১	১০.০	৫০	১২	সর্বোচ্চ ১০মি. উচ্চতা পর্যন্ত ৭২% ভূমি ব্যবহার		
Type C: প্রতিষ্ঠান সমূহ, Type D: স্বাস্থ্য বিষয়ক	C1-C4 D1-D2	-	-	-	-	-	-	৩.২৫	৬০	৯	৩.৫	৫০	১	৪.০	৫০	১	৫.০	৩০	১২	NR	৫০	১৮
																	সর্বোচ্চ ১০মি. উচ্চতা পর্যন্ত ৭২% ভূমি ব্যবহার			সর্বোচ্চ ১০মি. উচ্চতা পর্যন্ত, ৭২% ভূমি ব্যবহার		
Type E: মিলন স্থল এবং Type F: দোকান এবং প্রতিষ্ঠানিক	E1-E5 F2-F3	২.০	৬৫	৯	২.৫	৬০	২	৩.০	৫০	২	৩.০	৫০	২	৩.২৫	৫০	১২	৩.২৫	৫০	১৮	৪.০	৫০	১৮
Type G: কারখানা, Type H: গুদাম, Type J: বিপজ্জনক, Type K: অন্যান্য [৩]	G1-G2 H1-H2 J1-J2 K1-K2	২.০	৬৫	৯	২.০	৬৫	৯	২.০	৬৫	৯	২.০	৬০	৯	৩.০	৬০	৯	৩.৫	৫০	১২	৪.০	৫০	১২

ব্যাখ্যা : Not-Restricted (NR) বাধ্যবাধকতা নেই।

১) নীচে বর্ণিত ব্যবহার ট্রাফিক, পার্কিং এবং অন্যান্য চাহিদা পূরণ সাপেক্ষে আবাসিক এলাকায় চলতে পারে।
- ক) ডরমিটরী, হোস্টেল, শিশু নিবাস, প্রতিমধ্যন্য এবং বৃদ্ধ নিবাস।
- খ) দূতাবাস এবং কূটনৈতিক মিশন।
- গ) সর্বাধিক ২০ কক্ষ বিশিষ্ট হোটেল বা লজ।
- ঘ) অনূর্ধ্ব ১০০ বর্গমিটারের রেস্টুরেন্ট।

ট্রাফিক কন্ট্রোল, পার্কিং এবং অন্যান্য আনুষঙ্গিক চাহিদা পূরণ সাপেক্ষে আবাসিক ভবনের নীচতলায় নিম্নবর্ণিত ব্যবহারসমূহ করা যাইতে পারে।
- ক) পেশাজীবীদের অফিস, স্টুডিও বা চেম্বার যা ১০০ বর্গমিটারের বেশী নয় (পেশাজীবী বলতে আইনজীবী, প্রকৌশলী, স্থপতি, নগর পরিকল্পনাবিদ, ডাক্তার, ইন্টেরিয়র ডিজাইনার, গ্রাফিক ডিজাইনার আই.টি. উপদেষ্টা, শিল্পী, তুটির শিল্প এবং ছোট শিল্পকারখানার উদ্যোক্তা যেখানে সকাল ৮:০০ থেকে রাত ৮:০০ পর্যন্ত সময়ে ১৫ জনের বেশী কর্মচারী কর্মরত নহে এবং যা দূষণমুক্ত পরিবেশ বোঝানো হয়েছে)।
- খ) অনূর্ধ্ব২৫ বর্গমিটারের সেলুন, বিউটি পারলার, ঔষধের দোকান, মুদি দোকান, দর্জির দোকান, ধোপার দোকান এবং এই নিয়ম শুধুমাত্র কর্নার প্লটের জন্য প্রযোজ্য।
- গ) কমিউনিটি হল, লাইব্রেরী, সভাকক্ষ, সোসাইটি অফিস, ব্যায়ামাগার ইত্যাদি এবং এই স্থাপনাসমূহ FAR-এর আওতামুক্ত হবে।
- ঘ) অনূর্ধ্ব ২০০ বর্গমিটারের ধর্মীয় উপাসনার স্থান।

২) ক) ন্যূনতম ৩.৬৫ মিটার প্রস্থ রাস্তা দ্বারা সংযুক্ত জমিতে ভবনের FAR-এর সূচক হবে ২ এবং

গ) ২৫-১০০ বর্গমিটার মাপের জমির ক্ষেত্রে নিম্ন ও নিম্নমধ্যবিত্ত আয়ের শ্রেণীর জন্য সরকারী অথবা ব্যক্তিমালিকানাধীন পরিকল্পিত আবাসন উন্নয়নের ক্ষেত্রে, যা সরকার কর্তৃক অনুমোদিত জাতীয় ইমারত নির্মাণ বিধিমালার আওতাভুক্ত, FAR-এর সূচক ২ হবে এবং সর্বোচ্চ ভূমি ব্যবহারের পরিমাপ প্রযোজ্য হবে। আনুষঙ্গিক অন্যান্য শর্তাবলী প্রযোজ্য সাপেক্ষে)।

(২) খ-১ : বিশ্ববিদ্যালয় শিক্ষা ও প্রশিক্ষণ কেন্দ্র। খ-২ : নার্সারী স্কুল, প্রাথমিক স্কুল, মাধ্যমিক স্কুল।

(৩) নীচতলায় সর্বোচ্চ নির্মিত জায়গা, (কক্ষ ও ব্যবহারিক স্থানসমূহ) ২০%এর বেশী হবে না, যা ছাত্র-ছাত্রীদের জন্য উন্মুক্ত জায়গা ব্যবহারের ক্ষেত্রে সহযোগী হবে। উক্ত স্থান FAR-এর আওতামুক্ত হবে।

(৪) নীচতলায় সর্বোচ্চ নির্মিত জায়গা, (কক্ষ ও ব্যবহারিক স্থানসমূহ) ৪০% এর বেশী হবে না, যা ছাত্র-ছাত্রীদের জন্য উন্মুক্ত জায়গা ব্যবহারের ক্ষেত্রে সহযোগী হবে। উক্ত স্থান FAR-এর আওতামুক্ত হবে।

(৫) অন্যান্য সকল নিয়মাবলী পূরণ সাপেক্ষে, বাণিজ্যিক ভিত্তিতে নির্মিত বহুতল গাড়ি পার্কিং ভবনের ক্ষেত্রে সর্বোচ্চ ভূমির ব্যবহার হবে ৭০%।

বিশেষ দ্রষ্টব্য :

০১) FAR এর সর্বোচ্চ মান এই টেবিলে নির্ধারণ করা হয়েছে ঘন বসতি এলাকার জন্য। ব্যবহারের ধরন সাপেক্ষে বিজ্ঞ কর্তৃপক্ষ দ্বারা নগরীর প্রান্ত-এলাকায় এবং অন্যান্য শহরে এই মান নিয়ন্ত্রণ / পরিবর্তন করা যেতে পারে।

০২) যদি রাস্তার প্রস্থ মাপ টেবিলে নির্দেশিত মাপের চেয়েও কম থাকে তবুও নির্মাতা / জমির মালিক আরও বেশী ভূমি ব্যবহার করতে চান তাহলে টেবিলে প্রদর্শিত FAR এর পরবর্তী নিম্নমান দ্বারা সমাধা করা যেতে পারে। FAR, ভূমি ব্যবহার ও রাস্তার প্রস্থতার মানগুলি কলামে প্রদর্শিত বিভিন্ন জমির মাপের হিসাবের সাথে মিলিয়ে দেখা যাবে না।

০৩) FAR, ভূমি ব্যবহারের পরিমাণ এবং সর্বনিম্ন রাস্তার প্রস্থতা ইত্যাদি নগর পরিকল্পনার মানগুলি নির্ধারিত মানুষের বাসস্থান অথবা দুস্থ জনগোষ্ঠীর আবাসনের ক্ষেত্রে কর্তৃপক্ষের বাধ্যানুসারে পরিবর্তনযোগ্য।

০৪) Detailed Area Plan সম্পাদন হইলে উল্লেখিত সকলী-৩ এর প্রস্তাবনা উক্ত প্লান অনুযায়ী পরিবর্তিত হইবে।

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B. Sc. Engineering (Civil)

Course Title : Engineering Materials — Course Code: CE 201
Time: 3.00 Hours — Full Mark: 150

*There are **EIGHT** questions. Answer any **SIX** questions including Question #1. Question #1 is compulsory. The figures in the right margin indicate the marks of the questions.*

1) For a building construction project, the FM of sand was recommended at 2.6. From the nearby market of the project, two sand samples (Sample A and Sample B) were collected and sent to a concrete laboratory for sieve analysis. The data sheet of the sieve analysis is given below. (25)

(i) Determine the FM of the sand samples.
(ii) Draw the grading curves of the sand samples.
(iii) In what proportion, are the sand samples to be mixed to get the recommended FM of 2.6?
(iv) Make comments on the sand samples based on the sieve analysis data and grading curve.

ASTM Sieve	Amount Retained (g)	
	Sample A	Sample B
3 inch	0	0
1.5 inch	0	0
¾ inch	0	0
3/8 inch	0	0
#4	0	0
#8	70	0
#12	70	0
#16	60	50
#30	50	40
#40	50	30
#50	35	70
#100	40	120
#200	20	40
Pan	5	50

Sieve Openings: #12 - 1.7 mm; #40 - 0.425 mm; #200 - 0.075 mm.

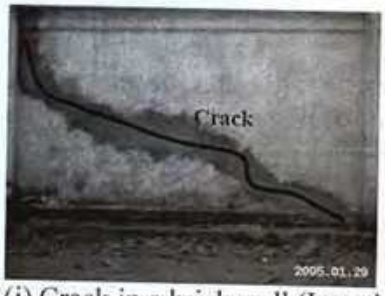
2(a) For a slab construction of a building project, concrete was designed with the following parameters: (15)

W/C = 0.50, Volume ratio of sand to aggregate = 0.40, Unit content of cement = 350 kg/m^3, Air content = 2.5%, Specific gravity of cement = 3.1,

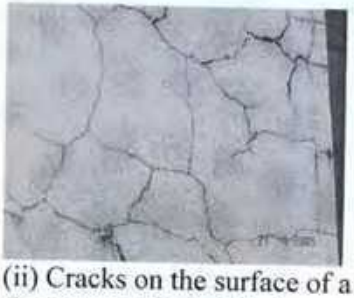
Specific gravity of water = 1.0, Specific gravity of sand = 2.65, Specific gravity of brick chips (SSD condition) = 2.0

(i) Calculate the volume of water, cement, sand and brick chips per cubic meter of concrete.
(ii) Calculate the unit weight of the concrete.
(iii) If the slab area is 100 ft by 100 ft and slab thickness is 6 inch, calculate the necessary amount of cement (in bags), sand (in cft), and brick chips (in cft) for the construction of the slab. Assume, the unit weight of sand and brick chips (with voids) are 1400 kg/m^3 and 1300 kg/m^3.

2(b) Refer to the following photographs (i) to (v). Explain the reasons of cracking or spalling of concrete. (10)

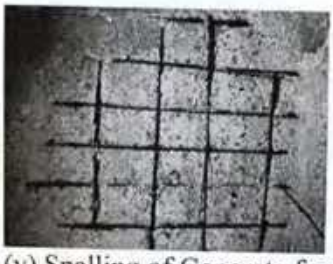


(i) Crack in a brick wall (Location: Dhaka City)


(ii) Cracks on the surface of a wall (Location : Dhaka City)

(iii) Cracks along the joint of parapet wall and roof slab (Location: Dhaka City)


(iv) Spalling of Concrete from a Lintel (Location: Chittagong)


(v) Spalling of Concrete from the bottom of a slab (Location : Dhaka City)

3	(a)	What is hydration of cement? Explain the hydration reactions of silicates and aluminates of cement.	(8)
	(b)	Explain the purpose of using gypsum in cement.	(3)
	(c)	Compare fine and coarse cement with respect to (i) hydration, (ii) strength, (iii) micro-cracking, (iv) durability, and (v) cost.	(5)
	(d)	"In hardened state of concrete, the transformation of monosulfate to ettringite is harmful" - Why?	(3)
	(e)	Compare creep and relaxation.	(3)
	(f)	Write short notes on (i) fatigue strength, (ii) ductility, and (iii) malleability.	(3)
4	(a)	Define crystal and amorphous structure. Explain (i) plain cubic unit cell, (ii) body centered cubic unit cell, (iii) face centered cubic unit cell, and (iv) closed packed hexagonal unit cell.	(8)
	(b)	Explain the objectives of seasoning of timber.	(3)
	(c)	What is the burning temperature of brick? How do bricks get strength at such a temperature? What will happen if the bricks are under-burnt or over-burnt?	(3)
	(d)	Define bulking of sand. Compare bulking of coarse, medium and fine sands.	(3)
	(e)	Explain electroplating.	(3)
	(f)	Explain the production process of natural rubber.	(3)
	(g)	Write the constituents of paint and varnish.	(2)
5	(a)	Explain seawater attack of concrete with chemical reactions.	(10)
	(b)	Explain five commonly found faults in construction projects which may cause early deterioration of concrete structures in Bangladesh.	(5)
	(c)	Explain five commonly found causes of deterioration (cracking/spalling) of concrete structures in Bangladesh.	(5)
	(d)	Define shrinkage of concrete. Write short notes (i) plastic shrinkage, (ii) drying shrinkage, and (iii) carbonation shrinkage.	(5)
6	(a)	Define normal consistency, initial setting time, and final setting time of cement.	(3)
	(b)	Define workability of concrete. How is it measured?	(3)
	(c)	Explain (i) segregation, (ii) bleeding, (iii) honeycomb, and (iv) laitance of concrete.	(8)
	(d)	"Curing of a slab is to be carried out more carefully compared to a beam" – why?	(3)
	(e)	Write short notes on (i) ferrocement, (ii) high performance concrete, (iii) light weight concrete, (iv) porous concrete, and (v) fly ash cement.	(5)
	(f)	"Cube strength of concrete is higher than the cylinder strength of concrete"- Why?	(3)
7	(a)	Explain the variation of compressive strength of concrete with respect to (i) W/C ratio, (ii) cement content, and (iii) size of aggregate.	(3)
	(b)	Explain chloride-induced corrosion and carbonation-induced corrosion of steel bars in concrete.	(5)
	(c)	What precautions are necessary to prevent early corrosion over the steel bar in concrete?	(5)
	(d)	Write short notes on (i) Veneer, (ii) Plywood, and (iii) Fiberboard	(6)
	(e)	Why is super plasticizer used in concrete?	(3)
	(f)	Explain three defects of timber.	(3)

8 (a) Compare blended cement and ordinary Portland cement with respect to (i) strength development, (ii) curing, and (iii) environmental benefits. (3)

(b) Write the characteristics of a good quality paint. (3)

(c) Discuss the changes in workability of concrete for the following cases: (7)

(i) W/C is increased at site
(ii) Cement content is increased at site
(iii) A relatively fine sand is used instead of a specified coarse sand
(iv) Water reducing admixture is used which was not specified in the mix proportion
(v) Mixing for a long time
(vi) Brick chips are used instead of round-shaped shingles
(vii) Damp sand is used instead of specified SSD sand

(d) Write the characteristics of good quality brick. (4)

(e) Explain the morphology of the following hydration products: (5)

(i) CSH
(ii) CH
(iii) $3CaO.Al_2O_3.CaSO_4,12H_20$
(iv) $3CaO.Al_2O_3.3CaSO_4,32H_20$
(v) $3CaO.Al_2O_3.CaCl_2,18H_20$

(f) Explain the purpose of using an accelerator in a concrete mix. (3)

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007

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 are the major causes of river erosion? Discuss, in brief, the way hydraulic actions affect river erosion. **1.5 + 4.5 = 6**

(b) Prove the following: **3.5 + 3.5 = 7**

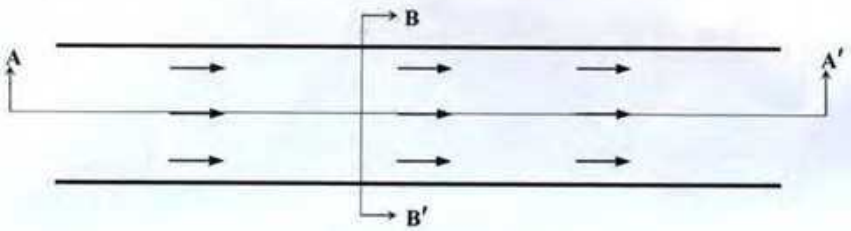
(i) For a rectangular channel having D >>>> B, $\tau \alpha$ B

(ii) For a triangular channel having D >>>> T, $\tau \alpha$ T

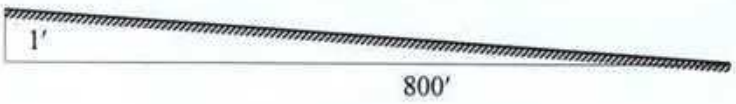
where

τ = unit tractive force along the channel bottom
D = depth of channel
B = bottom width of rectangular channel
T = top width of triangular channel

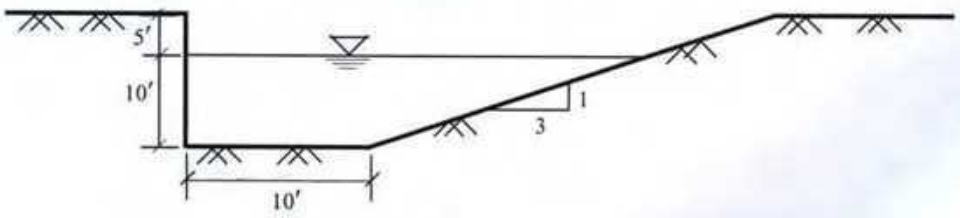
(c) The longitudinal and cross-sectional profile of a channel is shown in the following figure below. Calculate the unit tractive force along the channel bottom. **7**



Plan of a Channel Course



Section A-A′
(Longitudinal Profile)

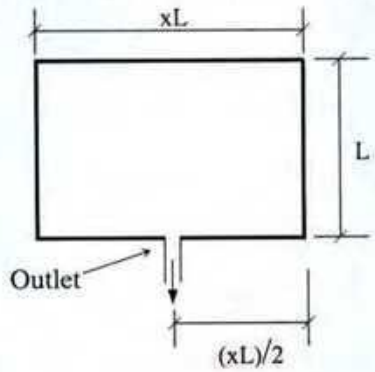


Section B-B′
(Cross-Sectional Profile)

2. (a) Distinguish between infiltration and percolation. **2**

(b) Derive an expression to find the relationship between CC (Compactness co-efficient) and FF (Form factor) of drainage basin. **4**

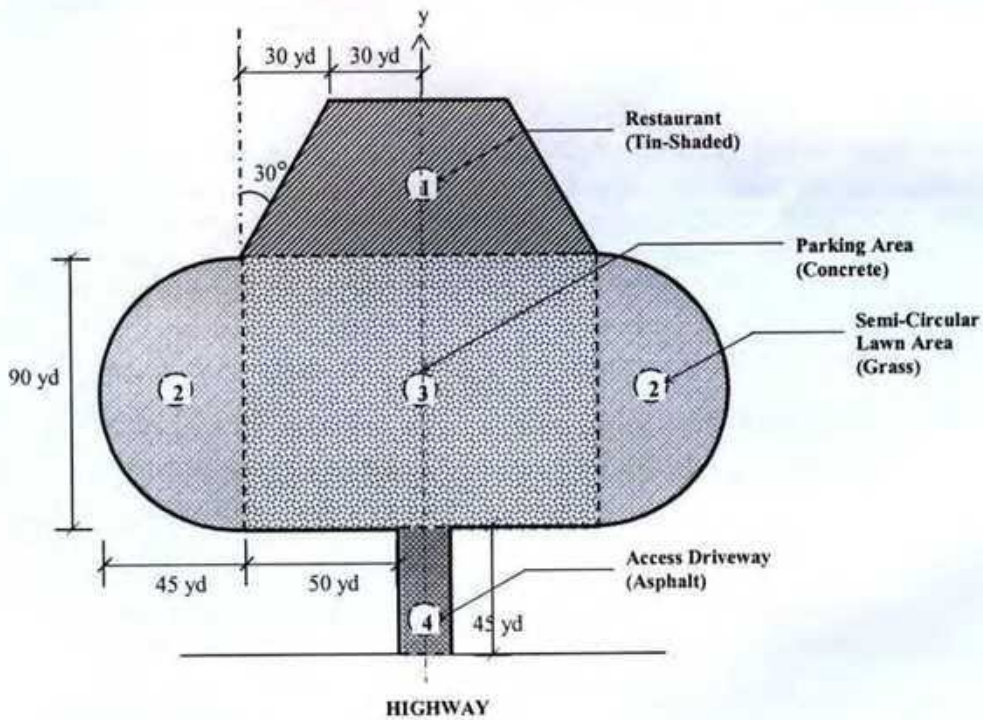
(c) For the following basin, x is a constant factor. For what value of x, the flow rate (Q) will be the maximum for the basin ? Find the FF and CC of the basin for maximum runoff. 4 + 2 = 6



(d) Calculate the peak runoff (Q_P) for the following highway restaurant complex as shown below. Use the following data/information as necessary. 8

- Rainfall Intensity for the whole area = 1.75 in/hr
- The area is symmetric about y direction.

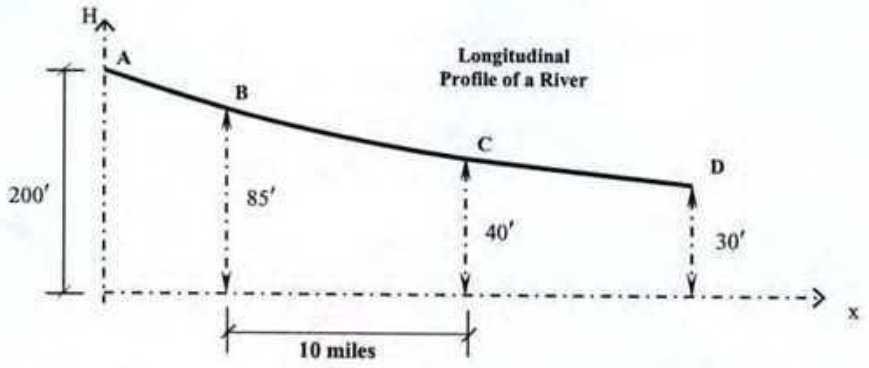
Area Type	Co-efficient of Runoff
Concrete	0.8
Asphalt	0.75
Grass	0.25



3. (a) Define river transportation, load, capacity and competence. Categorize (mention names only) load of a river. 2 + 1 = 3

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

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



d) The number and stream ranks of a catchment area of 1,175 square miles are calculated and the results of the survey are summarized in the table below. **8**

Sream Rank	No. of Streams	Average Length (mile)
1	22	1.1
2	9	2.4
3	4	6.4
4	1	18.3

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

4. (a) Classify (mention names only) drainage pattern. Sketch any six types of drainage pattern. **2 + 6 = 8**
(b) What is a river valley? Mention the names of the actions/processes that are responsible for valley deepening, widening and lengthening. **1 + 4 = 5**
(c) Classify (mention names only) valley according to the stage, genesis and controlling structures. Discuss, in brief, different types of valleys based on stage. **2.5 + 4.5 = 7**

Section B

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

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

2. (a) Write short notes on folds, faults, joints and rock cleavage. **4**
(b) Classify (mention names only) and draw sketches of different types of faults. **6**
(c) Classify and discuss briefly (with neat sketches), various type of folds based on geometry. **10**

3. (a) Classify and describe major minerals. Distinguish between Ferromagnesian and Non-Ferromagnesian Silicates. **8 + 2 = 10**
(b) Discuss liquefaction phenomenon (with basic mechanism) due to earthqueke. **5**
(c) Classify and discuss, in short (no sketch is required), various earthquake waves. **5**

4. Briefly discuss (or draw sketches as asked) the following topics :- **4 × 5 = 20**
(i) Principal zones of the earth
(ii) Typical geometry of a fold (with neat sketch)
(iii) Neat sketches of Horst and Graben
(iv) Major earthquake parameters with neat sketches

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007

Course No: CE 205
Course Title: Numerical Analysis & Computer Programming

Full Marks: 150
Time: 3.0 hours

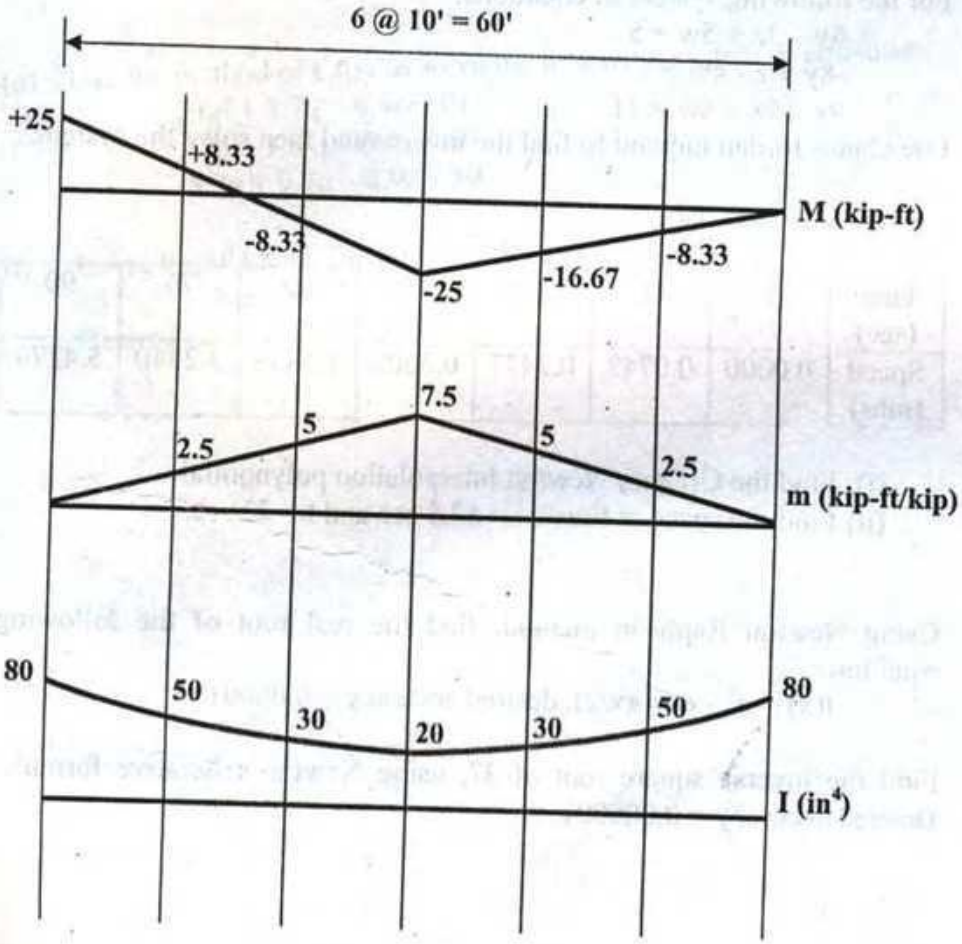
There are **TEN** questions. Answer any **EIGHT**.

1. Approximate the following definite integrals, using Gaussian Quadrature. **(18.75)**

(a) $I = \int_0^2 x^3 \sin x \, dx$ (for n =2)

(b) $I = \int_{-1}^{1} (x^2 + 7) \cos^2 x \, dx$ (for n = 3)

2.(a) The following diagrams show the variation of Bending Moments M and m and Moment of Inertia I in a beam. Estimate $\int (Mm / I) \, dx$ and mid point deflection of the beam, if E = 30,000 ksi. **(8.75)**



2.(b) Using the Simpson's rule, evaluate the following integral: **(10)**

$I = \int_{3}^{5.4} 15 \log_e x \, dx$, consider eight equal subdivisions and compare with the exact value.

3. Using Modified Euler method, evaluate the numerical solution of the following ordinary differential equation: **(18.75)**

$y' = dy / dx = (1/3) * (1+x^2) * y^3$, for $x = 0.2$ and 0.3.

Here, $y = 2$ at $x = 0$.

Show at least five trials.

4. Fit the curve $y = a\,x^b$ to the following set of points. **(18.75)**

x	1.7	3.4	5.4	7.2	9.3	11.5	13.6	15.8
y	37	49	51	63	76	86	97	125

Find the value of y corresponding to $x = 12.94$, from the fitted curve.

5. Using the given data in Question 4, find the value of y, corresponding to $x = 3.79$. Use Lagrangian Polynomial formula. **(18.75)**

6. For the following system of equations: **(18.75)**

$6y - 3z + 5w = 5$

$-8y + z - 4w = 6$

$9y - 5z + 6w = 11$

Use Gauss Jordan method to find the inverse and then solve the system.

7. For the following data, **(18.75)**

Time (sec)	0	15	30	45	60	75	90
Speed (mps)	0.0000	0.0742	0.2477	0.5602	1.5831	3.2340	5.4276

(i) Find the Gregory Newton Interpolation polynomial.

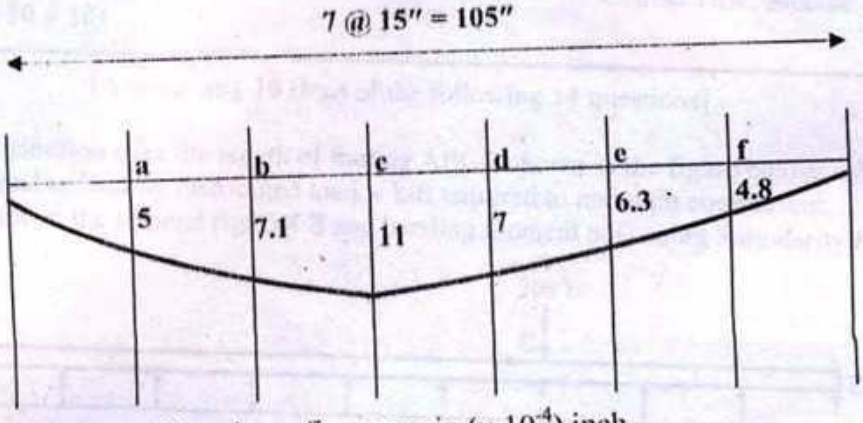
(ii) Find the speed at times, $t = 57.5$ sec and $t = 73$ sec.

8.(a) Using Newton Raphson method, find the real root of the following equation: **(10)**

$f(x) = e^x - \cos(\pi x/2)$, desired accuracy = 0.00001

(b) Find the inverse square root of 37, using Newton's Iterative formula. Desired accuracy = 0.000001. **(8.75)**

9. Experimentally observed values of deflections of a beam are shown in the following figure. **(18.75)**



All deflections of the above figure are in ($\times 10^{-4}$) inch.

Calculate :

(i) The bending moments at points **b** and **d**.

(ii) The shear forces at points **c** and **e**.

(iii) The slopes at points **b** and **e**.

Given, E = 30,000 ksi, I = 1000 in^4. The bending moment at any section of a beam is given by the equation of $M = -EI\, D^2y$.

10.(a) Use the method of **Chio** to solve the following system of equations: **(10)**

$$2.6p + 3.7q - 6.9r = 19$$
$$7.2p - 7.8q + 5.3r = 39$$
$$-5.7p + 9.3q - 4.9r = 59$$

(b) Using Regula Falsi method, find the root of the following equation: **(8.75)**

$$x^2 \log_{10} x - 5x + 7.9 = 0$$

Desired accuracy = 0.00001.

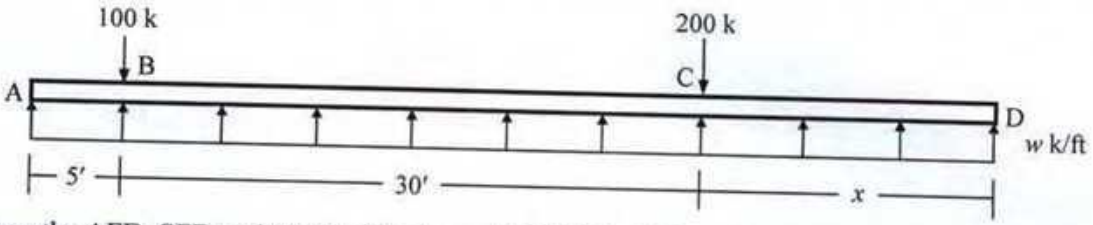
The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007

Course # CE 211
Full Marks: 100 (= 10 × 10)

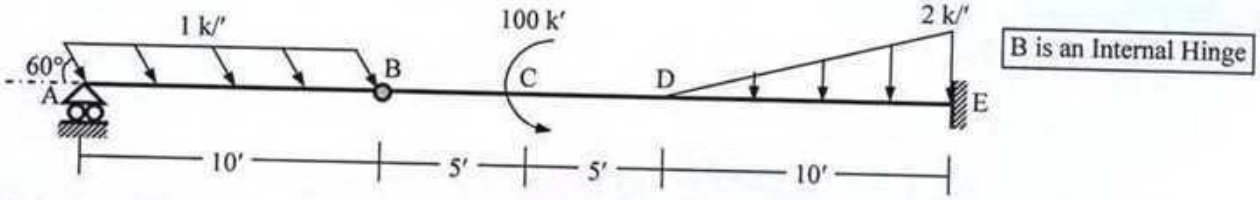
Course Title: Mechanics of Solids I
Time: 3 hours

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

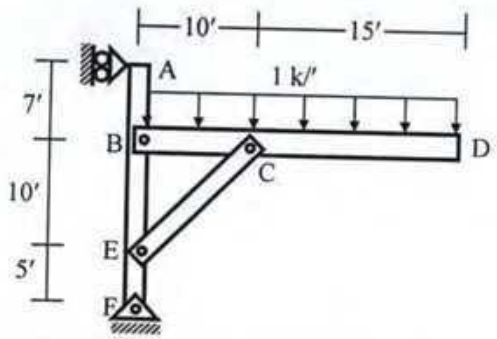
1. For the load distribution over the length of footing ABCD shown in the figure below, calculate
(i) the length x and uniformly distributed load w k/ft required to maintain equilibrium,
(ii) the shear force at the left and right of B and bending moment at C using Singularity Functions.



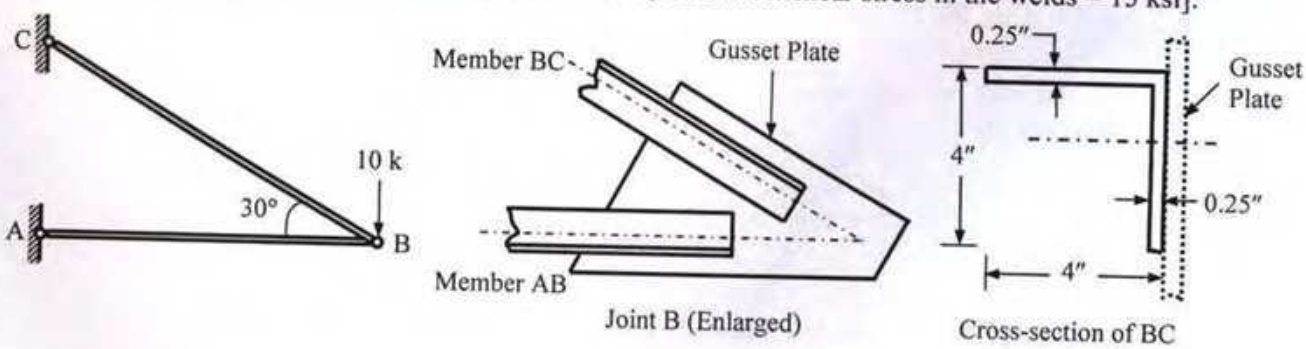
2. Draw the AFD, SFD and BMD of the beam ABCDE loaded as shown below.



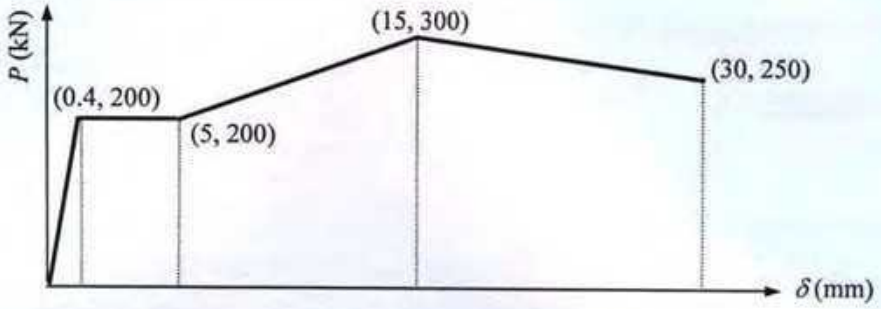
3. Draw the AFD, SFD and BMD of the column ABEF in the frame structure loaded as shown below [Given: B, C, E and F are pin joints].



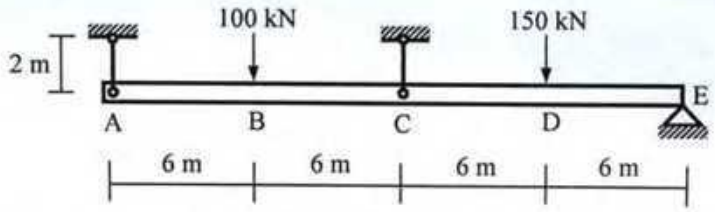
4. In the structure ABC loaded as shown in the figure below,
(i) Check the adequacy of the member BC,
(ii) Design the welds for member BC with Gusset Plate at joint B
[Given: Allowable axial stress in member BC = 18 ksi, Allowable shear stress in the welds = 15 ksi].



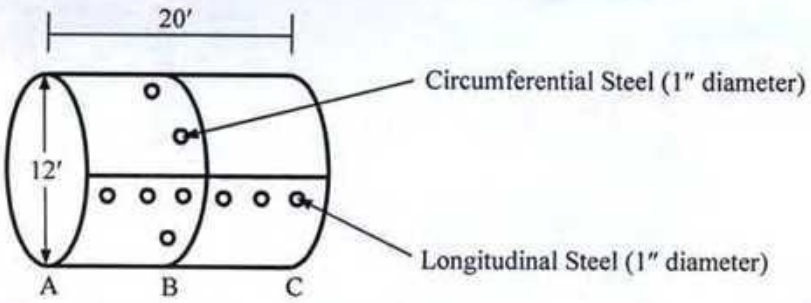
5. The figure below shows the axial force (P) vs. elongation (δ) diagram of a 200 mm long mild steel specimen of 25 mm diameter. Calculate the (i) Young's modulus, (ii) apparent and actual breaking strength and (iii) energy needed to break the specimen.



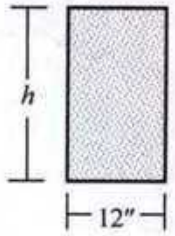
6. The figure below shows a rigid beam ABCDE being supported by a pin support at E and two linearly elastic wires at A and C. The area of both the wires at A and C is 100 mm^2. Calculate
   (i) the reactions at wires A, C and support E and
   (ii) elongation of wires at A and C [Given: Modulus of elasticity of wires = 200 GPa].



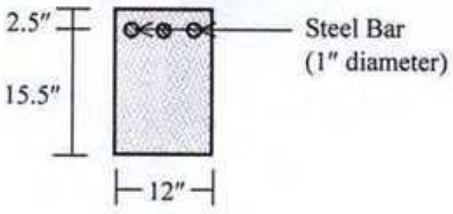
7. The figure below shows a gas cylinder ABC of 12′ diameter and 0.25″ wall thickness. Calculate the
   (i) maximum internal pressure that the cylinder can be subjected to
   (ii) corresponding tangential and longitudinal stresses and strains in the wall of the cylinder
   (iii) required spacing of 1″ diameter bolts to resist the wall stresses
   [Given: Allowable tensile stress in the wall = 20 ksi, Allowable shear stress in bolts = 16 ksi, Modulus of elasticity of steel = 30×10^3 ksi, Poisson's ratio = 0.25].



8. (i) Calculate the required depth 'h' if the Section 1 shown below (made of concrete) is subjected to a negative bending moment of 50 k-ft.
   (ii) Calculate the maximum flexural stress in concrete if the section is made of Reinforced Concrete as shown below in Section 2. Assume the section is 'cracked' due to concrete tension
   [Given: Allowable concrete stress in tension = 200 psi, compression = 1500 psi, n = 10].

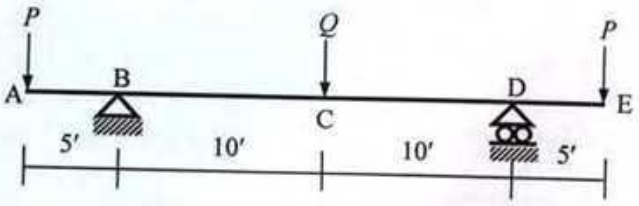


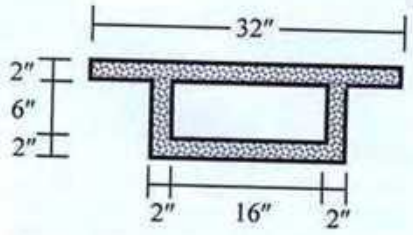
Section 1 (Concrete)



Section 2 (Reinforced Concrete)

9. Calculate the maximum tensile and compressive flexural stresses in the cross-section of the beam loaded as shown below, if $P = 5$ k and $Q = 15$ k.

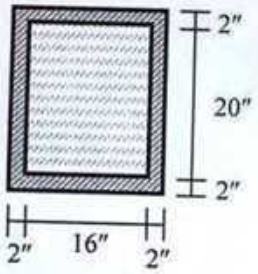




Cross-section of the beam

10. Calculate the plastic section modulus (Z) and shape factor (α) of the section shown in Question 9.

11. For the beam described in Question 9, draw the flexural strain diagram over the composite cross-sectional area shown below at section C if $P = 0$ and $Q = 10$ k.
Also calculate the maximum stress in timber and aluminum.



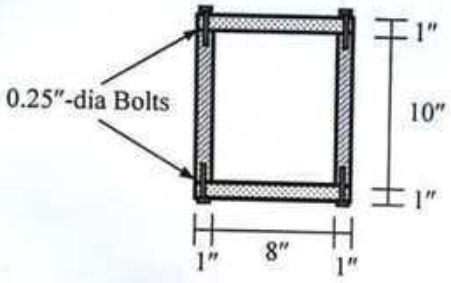
Composite cross-section

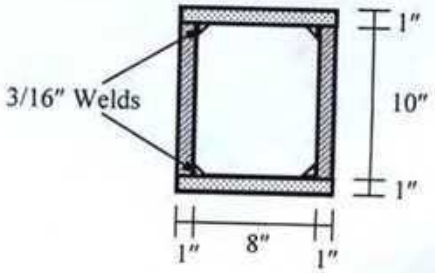
Timber $E_t = 2000$ ksi

Aluminum $E_a = 10000$ ksi

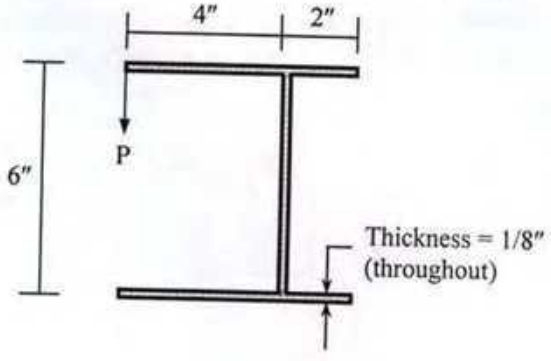
12. Draw the shear force diagram for the beam loaded as shown in Question 9 and shear stress diagram over the cross-section where the shear force is the maximum.

13. Rectangular plates are joined by 0.25″-dia bolts spaced 3″c/c or 3/16″ thick welds to form the section shown below. Calculate the allowable shear force in the section if allowable shear stress is 15 ksi.





14. The cross-sectional area of a beam is shown below by centerline dimensions. If the self-weight of the beam is 50 lb, calculate the magnitude of force P needed to avoid torsion in the section.



The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B. Sc Engineering (Civil)

Course Title: Mechanics of Solids II Course Code: CE 213 Credit: 3.00
Time : 3.00 Hours Full Marks:100 (= 10 × 10)

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

1. In the Fig.1 shown below, calculate the minimum permissible diameter d if the allowable shearing stress is 6000 psi and the total twist between A and C is limited to 3^0 [Given: G = 12000 ksi].

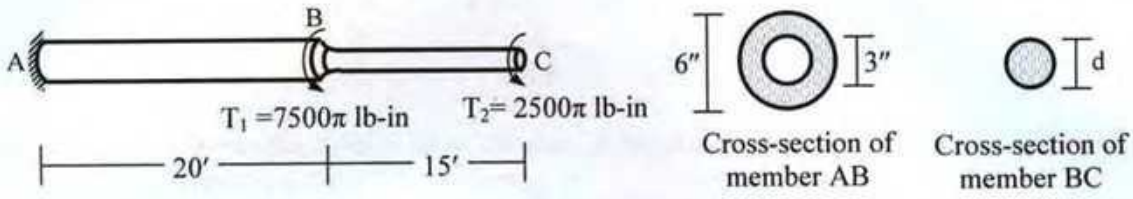


Fig.1

2. Calculate the magnitude and location of the maximum shear stress in the compound section shown in Fig.2 when subjected to a torque of 15 k-ft.[G=12000 ksi].

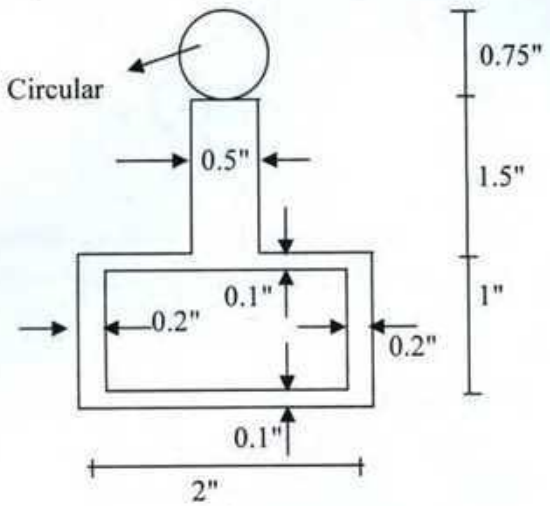


Fig.2

3. A simple beam with depth to width ratio of 2:1 is to span 3.6m and carry UDL of 21kN/m as shown in Fig.3. The loading plane is inclined 30^0 clockwise with vertical. Determine the required dimension (b h) so that the maximum stress due to bending does not exceed 12 MPa. Neglect self weight of beam. Also locate the neutral axis.

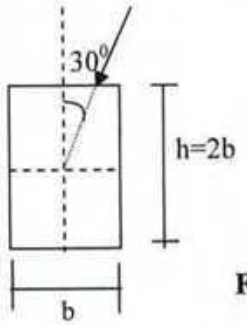


Fig.3

4. A rigid weightless bar hinged at one end is supported by two identical springs as shown in Fig.4. Compute the maximum shearing stress in the springs [Given: Both springs have coil diameter = 10 mm, number of coils = 20 , average spring diameter = 150 mm].

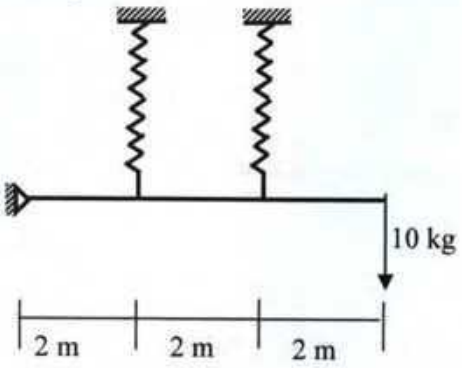


Fig.4

5. The Fig.5 below shows the stresses on an element. If the maximum principal stress on it is 45 ksi,
a) Calculate the stresses on a plane b-b' as shown.
b) Show the stresses on plane b-b' graphically using Mohr's circle.

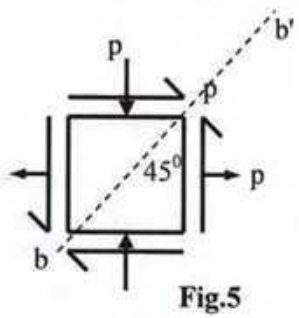
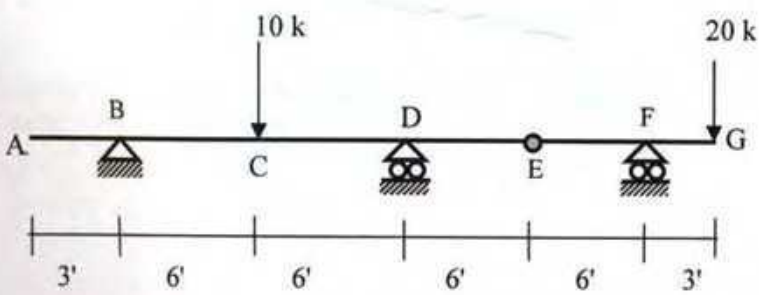


Fig.5

6. For the stress condition described in Question 5(with maximum principal stress 45 ksi), calculate the required yield strength f_y to avoid yielding of the material using the yield criteria suggested by
(i) Rankine, (ii) St. Venant, (iii) Tresca, (iv) Von Mises [Given: Poisson's ratio = 0.25].

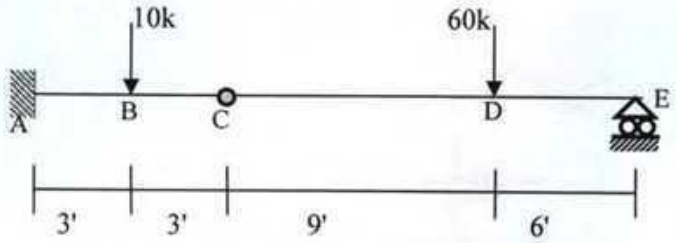
7. Using the Conjugate beam method find rotations at locations C and E of the beam shown in Fig.6. Find also the deflections at locations C and E of the beam [EI= 40000 k-ft^2].



E is an Internal Hinge

Fig.6

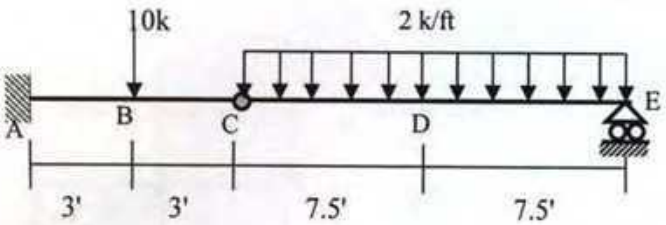
8. For the beam shown in Fig.7, use the Moment-Area Theorems to calculate the deflection at C and rotations at the left and right of C [EI=40000 k-ft^2].



C is an Internal Hinge

Fig.7

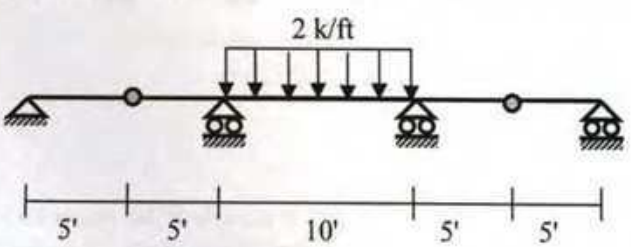
9. For the beam shown in Fig.8, use the singularity functions to calculate the deflections at C, D and rotations at the left and right of C [EI= constant].



C is an Internal Hinge

Fig.8

10. For the beams shown in Fig.9
   (i) Write down the expressions for loading function w(x) using singularity functions.
   (ii) Write down the corresponding 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.



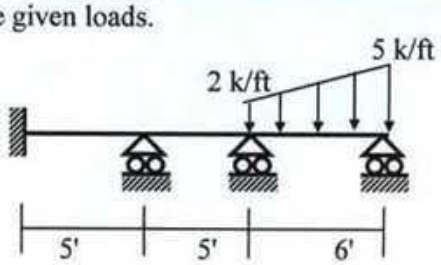


Fig.9

11. Draw the shear force and bending moment diagram of the beam shown in Fig. 10 [Given: EI = constant].

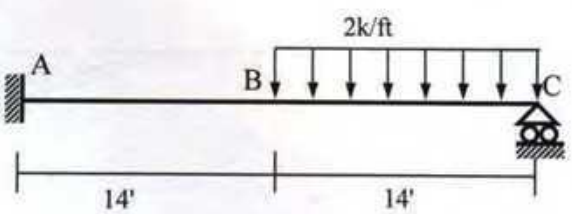


Fig.10

12. Use the AISC-ASD criteria to calculate the allowable value of F to avoid buckling of any member of the truss shown in Fig. 11[Given: Member cross section is as shown, with E= 29000 ksi, f_y=40 ksi].

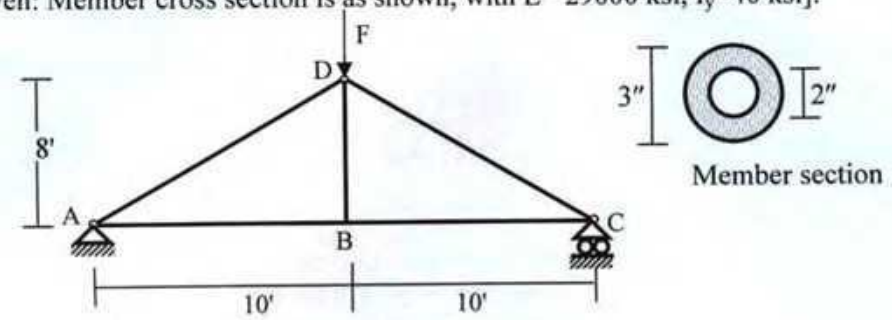


Fig.11

13. Calculate the critical buckling loads for columns AB and CD in the frame shown below [Given: E=2000 ksi, EI =constant].

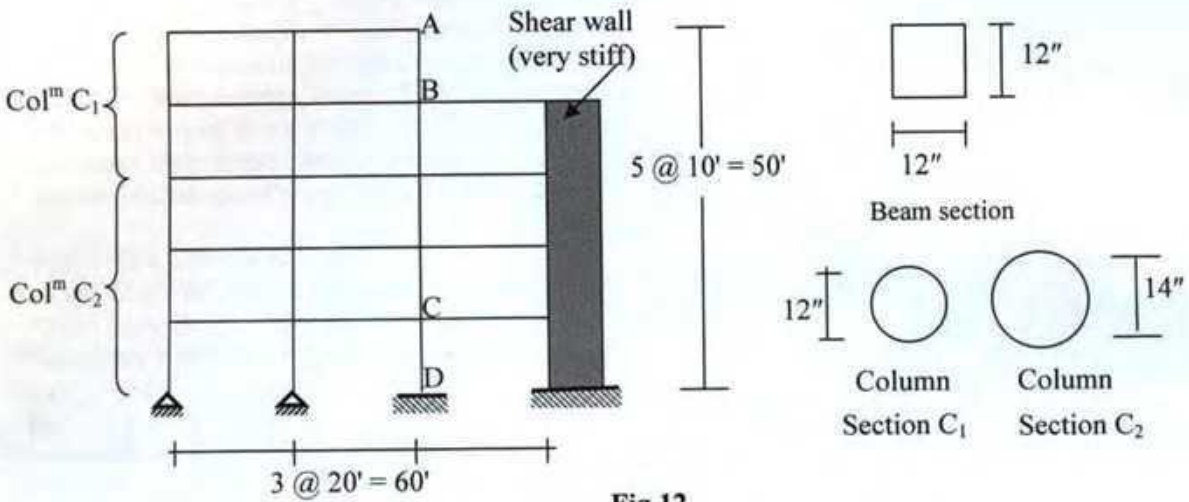


Fig.12

14. The beam ACB shown in Fig. 13 has an initial deflected shape of $v_i(x)=V_{oi}\ \mathrm{Sin}(\pi x/L)$. If the deflection at C is 1.5" when P= 150k and 3" when P= 250k, calculate the height h of the beam section and the deflection at C, when P= 300k [Given: E= 3000 ksi]

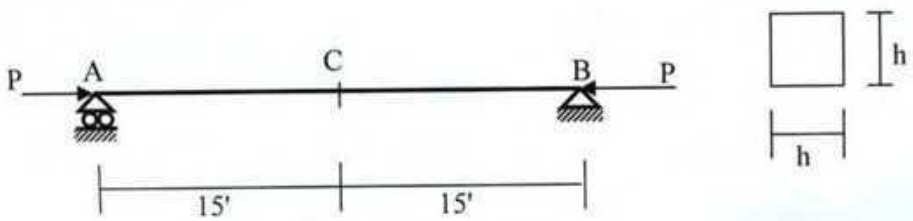


Fig.13

List of Useful Formulae for CE 213

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

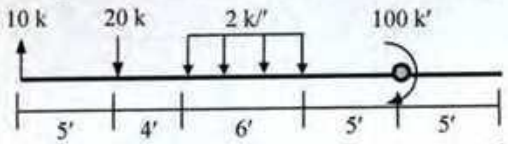
Section	Torsional Shear Stress	J_{eq}
Circular	$\tau = Tc/J$	$\pi d^4/32$
Thin-walled	$\tau = T/(2\textcircled{A}\, t)$	$4\textcircled{A}^2/(\int ds/t)$
Rectangular	$\tau = T/(\alpha bt^2)$	βbt^3

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

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

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

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

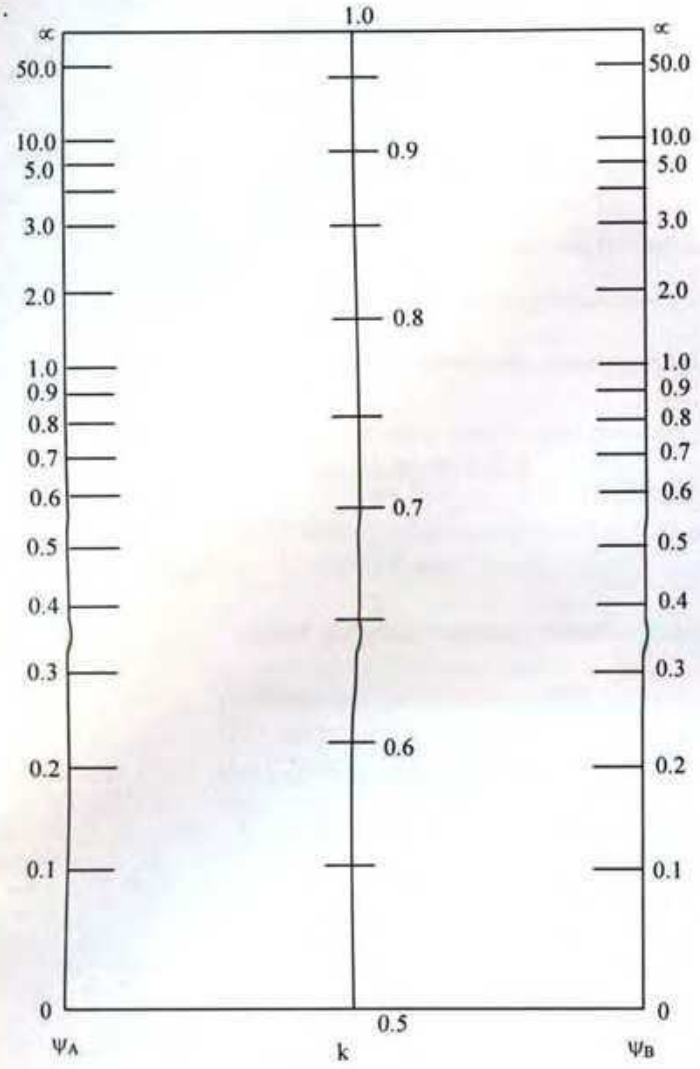


$$w(x) = 10\langle x-0\rangle^{-1} - 20\langle x-5\rangle^{-1} - 2\langle x-9\rangle^{0} + 2\langle x-15\rangle^{0} + 100\langle x-20\rangle^{-2} + C_0\langle x-20\rangle^{-3}$$

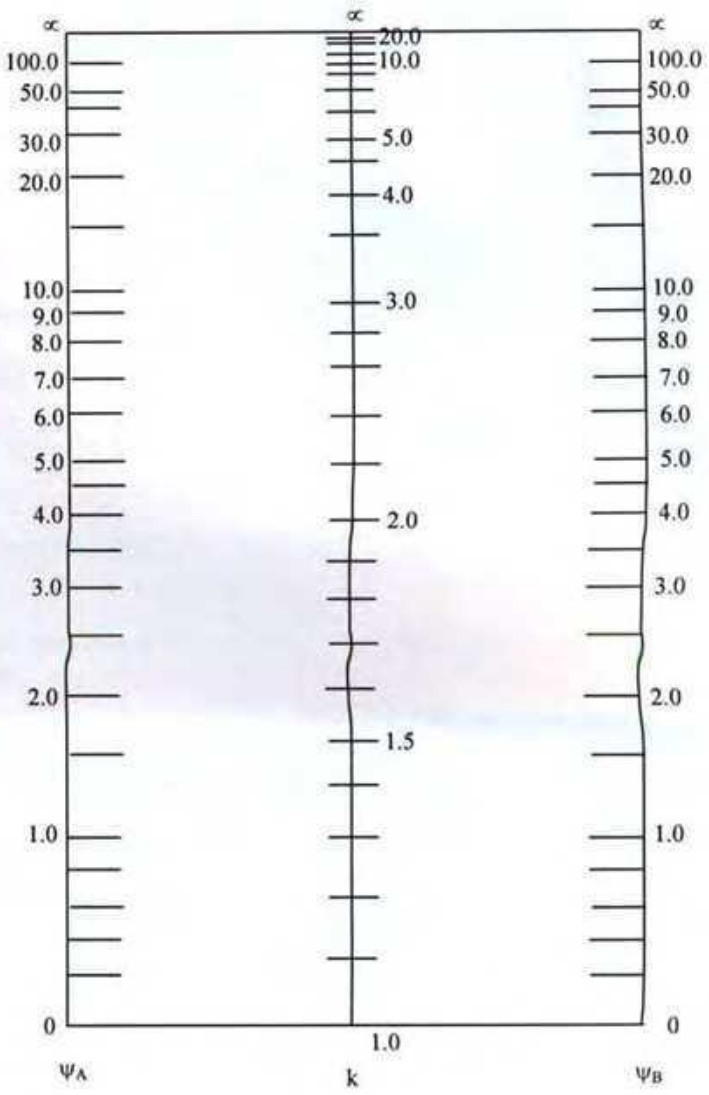
* First Moment-Area Theorem: $\theta_B - \theta_A = \int (M/EI)\, dx$
* Second Moment-Area Theorem: $(x_B - x_A)\,\theta_B - v_B + v_A = \int x\,(M/EI)\, dx$
* Conjugate Beam Method

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

* Euler Buckling Load: $P_{cr} = \pi^2\, EI_{min}/(kL)^2$
* Effect of Initial Imperfection: $v(x) = v_{0i}/[1 - P/P_{cr}] \sin(\pi x/L) \Rightarrow v(L/2) = v_{0i}/[1 - P/P_{cr}]$
* Effect of Load Eccentricity: $\lambda^2 = P/EI \Rightarrow v(L/2) = e\,[\sec \lambda L/2 - 1] = e\,[\sec\{(\pi/2)\sqrt{(P/P_{cr})}\} - 1]$
* Effect of Material Nonlinearity: $P_{cr} = \pi^2\, E_t I/L^2 \Rightarrow \sigma_{cr} = \pi^2\, E_t/\eta^2$
* Eccentric Loading with Elasto-plastic Material:
  $v(L/2) = e\,[\sec\{(\pi/2)\sqrt{(P/P_{cr})}\} - 1]$ for the elastic range; and $v(L/2) = M_p/P - e$, for the plastic range
* k = 1.0 for Hinge-Hinged Beam, 0.7 for Hinge-Fixed Beam, 0.5 for Fixed-Fixed Beam, 2.0 for Cantilever Beam
  In general, k is obtained from ψ_A and ψ_B for braced and unbraced frames
* AISC-ASD Method, $\eta = L_e/r_{min}$, and $\eta_c = \pi\sqrt{(2E/f_y)}$
  If $\eta \leq \eta_c$, $\sigma_{all} = f_y\,[1 - 0.5\,(\eta/\eta_c)^2]/FS$, where $FS = [5/3 + 3/8\,(\eta/\eta_c) - 1/8\,(\eta/\eta_c)^3]$
  If $\eta > \eta_c$, $\sigma_{all} = (\pi^2\, E/\eta^2)/FS$, where FS = Factor of safety = 23/12 = 1.92
* Moment magnification factor for a Simply Supported Beam
  for concentrated load at midspan of = $[\tan(\lambda L/2)/(\lambda L/2)]$, subjected to end moments only = $[\sec(\lambda L/2)]$
  under UDL = $2\,[\sec(\lambda L/2) - 1]/(\lambda L/2)^2$, according to AISC code = $1/(1 - P/P_{cr})$



Braced Frames



Unbraced Frames

Alignment Charts for Effective Length Factors k

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

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B.Sc Engineering (Civil)

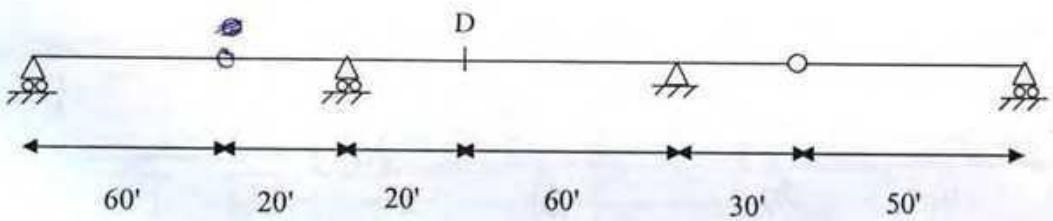
Course Title : Structural Analysis & Design I Course Code : CE 311 Credit: 3.00
Time: 3.00 Hours Full Mark:200

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

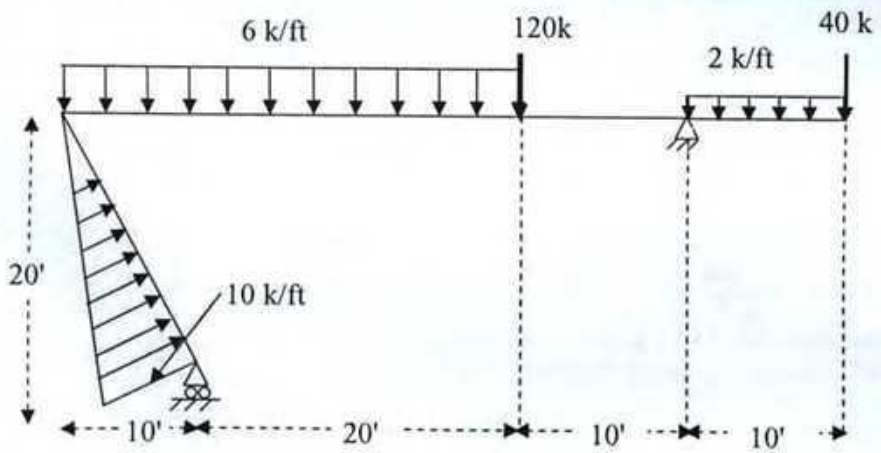
SECTION A

There are **FIVE** questions in this section. Answer any **FOUR.**
Total Marks: 25x4 = 100

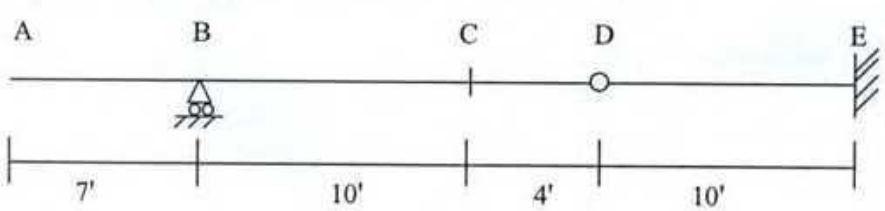
1. Using influence line, calculate the maximum positive shear and maximum negative shear that can be developed at point D in the beam shown in the figure below due to a uniform moving load of 4 k/ft.



2. Draw the shear force and bending moment diagrams for the following structure.

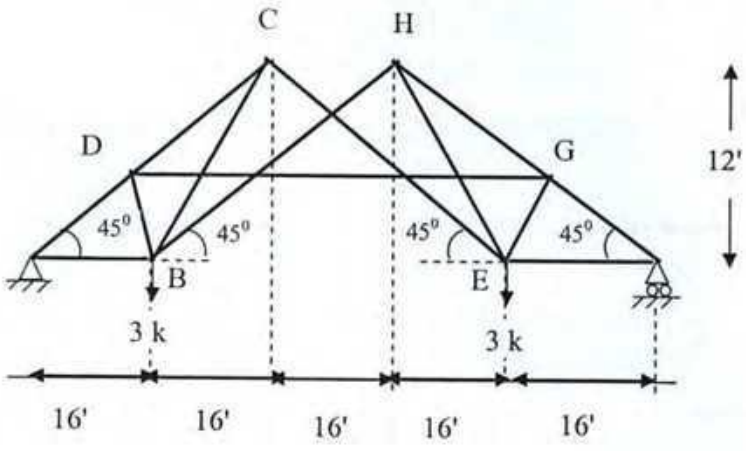


3. For the beam shown below, draw Influence lines for (i) Reaction at B, (ii) Shear at C, (iii) Shear just right of B and (iv) Vertical reaction at E (v) Moment at C.

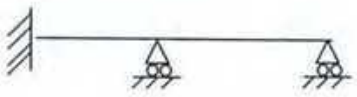


65

4. Determine the bar forces in members BH, CE and DG of the compound truss shown in the figure below.



5. (a) Classify each of the beams shown below as statically determinate or statically indeterminate, stable or unstable. If statically indeterminate, report the number of degrees of indeterminacy.

i) 

ii) 

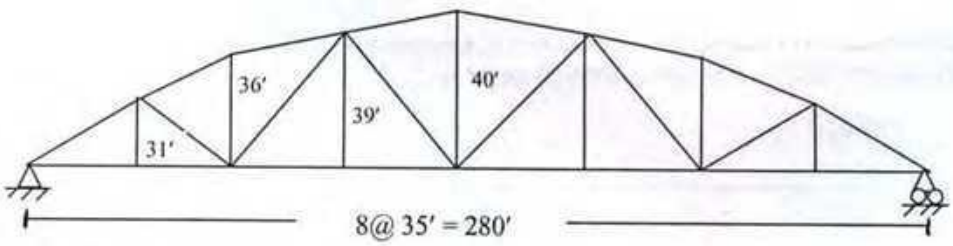
(b) Derive the "General Cable Theorem".
With the help of General Cable Theorem, derive an expression defining the shape of a cable subjected to uniformly distributed load with respect to horizontal axis with origin at left end of a cable.

SECTION B

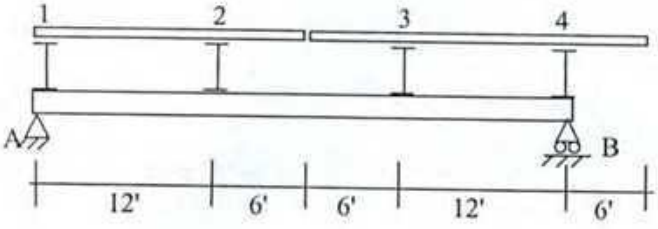
There are **FIVE** questions in this section. Answer any **FOUR**

Total Marks: 25x4 = 100

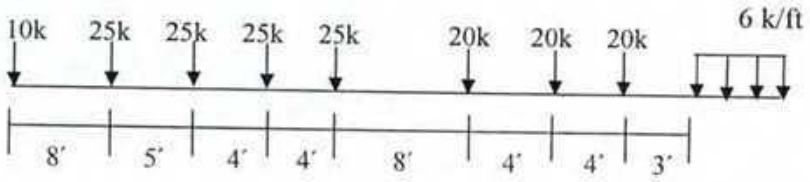
6. Due to a moving uniform live load of 3.5 kips per ft, combined with a roving concentrated live load of 60 kip, dead load 2 kips per ft, design counter for fourth panel from left for the truss shown in the figure.



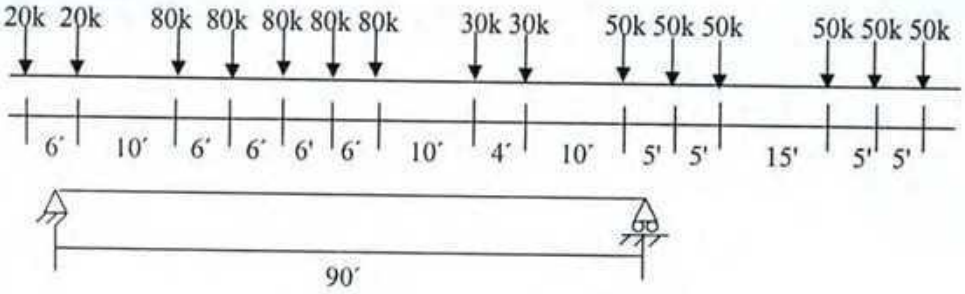
7. Girder AB supports a floor system as shown in the figure below. Draw the Influence line for (i)floor beam reaction at panel point "3", (ii) support reaction at "A", (iii) shear in panel 2-3 and (iv) bending moment for girder at panel point "2".



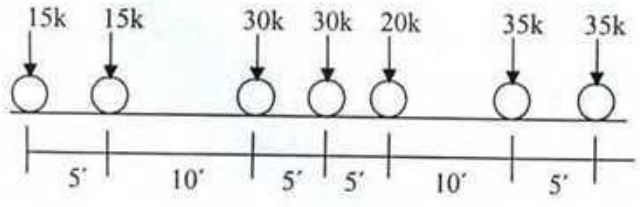
8. Calculate the maximum bending moment at the one-third point of a simply supported beam of span 70 ft due to the wheel loads shown in the figure below.



9. Calculate the maximum live load shear at the quarter point from the left support of a simply supported beam of span 90 ft due to the axle loads of a heavy freight locomotive shown below.



10. Calculate the absolute maximum moment for a simply supported beam of span 60ft due to the load shown below [Start trial with third wheel load (from left)].

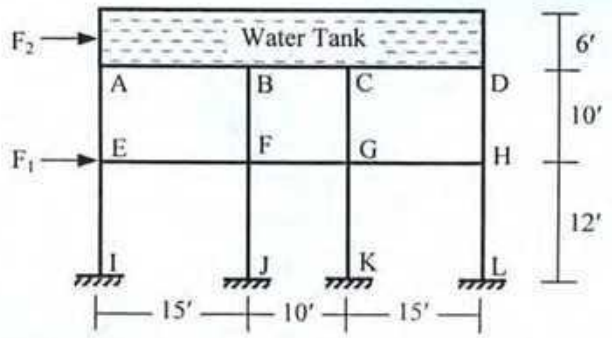


The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007

Course # CE 313 — Course Title: Structural Analysis & Design II
Full Marks: 100 (= 10 × 10) — Time: 3 hours

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

1. The two-storied RCC frame shown in the figure below carries a 6′ deep water tank on the top floor. If the areas of the beams and columns are negligible compared to the water tank, calculate
   (i) the story forces F_1, F_2 and base shear due to wind force if the average wind coefficients are $C_l = 1.0$, $C_z = 1.0$, $C_G = 1.2$, $C_t = 1.0$, $C_p = 1.1$, frame width = 20′, basic wind velocity = 150 mph,
   (ii) shear forces and bending moments in the first floor columns (using Portal Method).

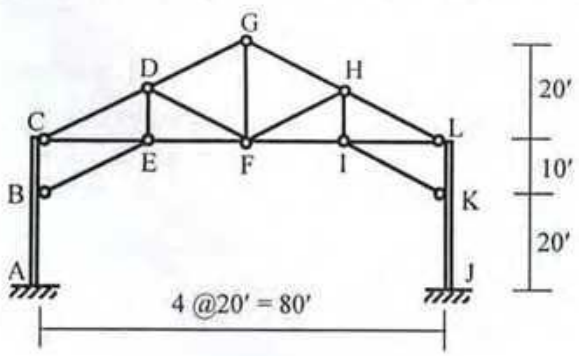


2. The two-storied RCC frame described in Question 1 carries a water tank (weighing 7.5 k/ft) on the top floor. If the weight of the beams and columns are negligible compared to the water tank, calculate
   (i) the story forces F_1, F_2 and base shear due to earthquake if Z = 0.15, I = 1.0, S = 1.5 and R = 4.0,
   (ii) axial forces in the first floor columns (using Cantilever Method, assuming same column areas).

3. For the structure described in Question 1, if the lateral forces are $F_1 = 0$ and $F_2 = 20$ k, calculate the
   (i) SF and BM in first floor columns (using Portal Method), if there are internal hinges at F and G,
   (ii) axial force in the top floor columns (using Cantilever Method), if the interior columns have twice the area of the exterior columns.

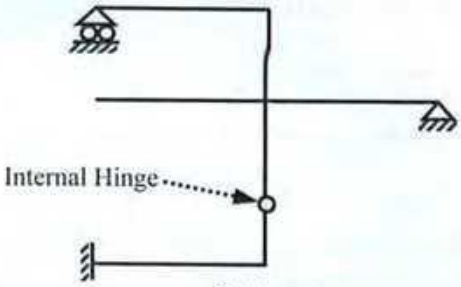
4. For the structure described in Question 1, draw the SFD and BMD of beams AB, BC and the AFD of columns EI, FJ for a vertical load of 7.5 k/ft on beam ABCD and negligible load elsewhere using
   (i) approximate locations of inflection points, (ii) ACI coefficients.

5. In the Mill Bent shown below, calculate the
   (i) wind forces on the truss if the average wind coefficients are $C_l = 1.5$, $C_z = 1.3$, $C_G = 1.1$, $C_t = 1.0$, distance between frames = 30′, basic wind velocity = 150 mph,
   (ii) support reactions at A and J due to the wind forces calculated in (i), using the Portal Method.

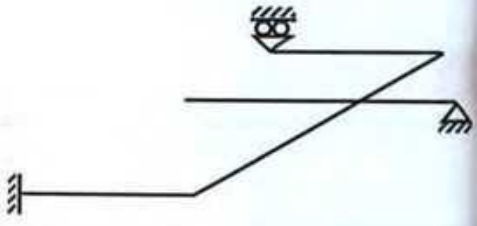


6. Determine the size of the flexibility matrix of the structures shown below.
Also convert them to statically determinate structures to be used in 'Case 0' of the Flexibility Method.

2D Truss

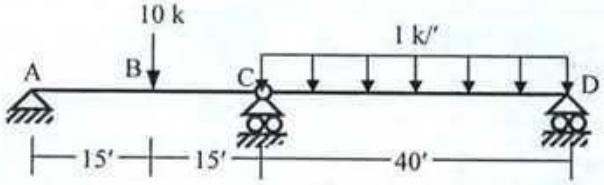


2D Frame



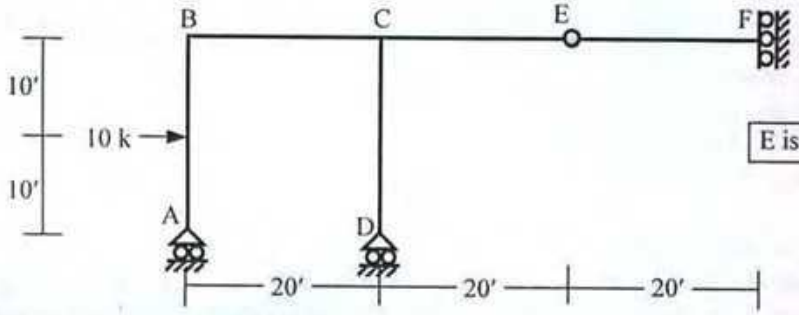
Grid

7. Use the Unit Load Method (considering flexural and shear deformations) to calculate the vertical deflection at B of the beam loaded as shown below [Given: $EI = 40\times10^3$ k-ft^2, $GA^* = 120\times10^3$ k].



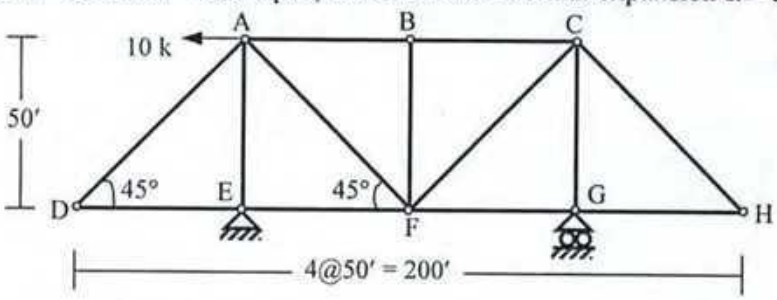
C is an Internal Hinge

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

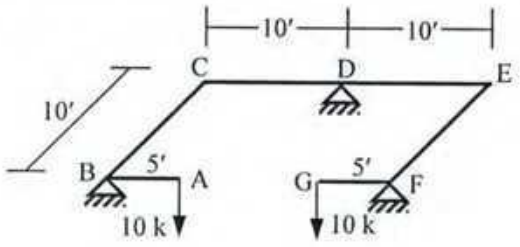


E is an Internal Hinge

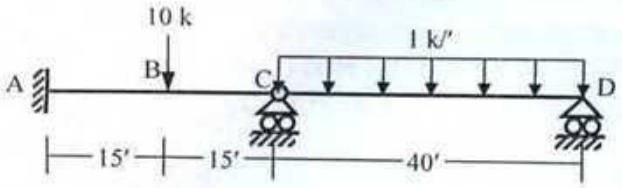
9. Use the Unit Load Method to calculate the horizontal deflection at A of the truss shown below due to (i) the applied loaded, (ii) temperature drop of 30°F in the bottom cords
[Given: EA/L = constant = 500 kip/ft, Coefficient of thermal expansion $\alpha = 5.5 \times 10^{-6}$/°F].



10. Use the Unit Load Method to calculate the vertical deflection at A of the grid shown in the figure below [Given: $EI = 40\times10^3$ k-ft^2, $GJ = 30\times10^3$ k-ft^2].

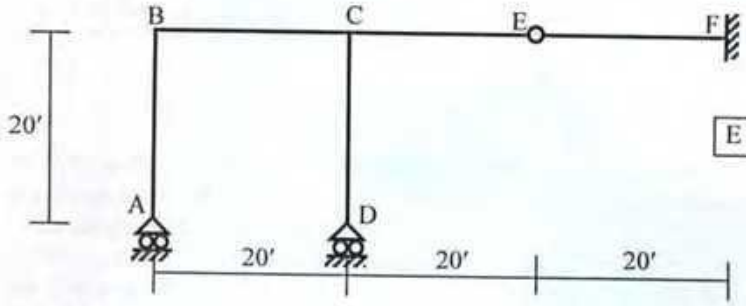


11. Use the Flexibility Method (considering flexural deformations only) to draw the bending moment diagram of the beam loaded as shown below [Given: EI = 40×10^3 k-ft^2].



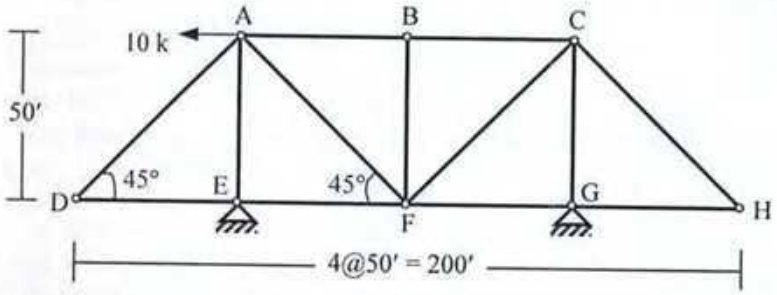
C is an Internal Hinge

12. Use the Flexibility Method (considering flexural deformations only) to draw the bending moment diagram of the frame shown below, if support F settles 0.10' downward [Given: EI = 40×10^3 k-ft^2].

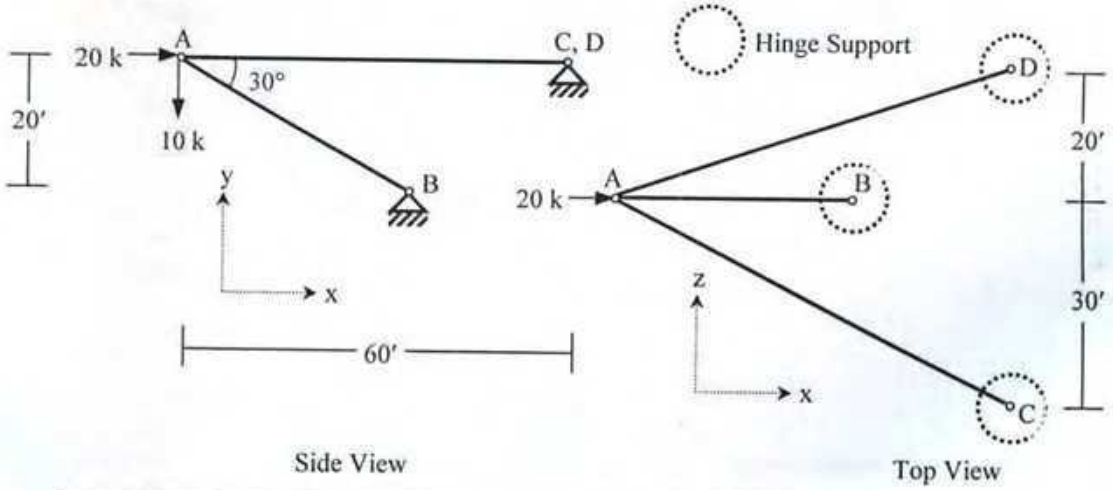


E is an Internal Hinge

13. Use the Flexibility Method to calculate the forces in all the members of the truss shown below, if in addition to the applied load, support G moves 0.10' leftward [Given: EA/L = constant = 500 kip/ft].



14. Calculate the support reactions at B, C and D and forces in members AB, AC and AD of the space truss loaded as shown below.



Side View

Top View

Nodal Coordinates
A (0, 0, 0), B (34.64, –20, 0), C (60, 0, –30), D (60, 0, 20)

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B. Sc. Engineering (Civil)

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

There are <u>EIGHT</u> Questions. Answer any <u>SIX</u> Questions.

1 (a) Design an exterior corner slab panel of 12 ft by 12 ft (clear span) for the following given conditions by USD. **(20)**

LL = 70 psf, partition wall = 30 psf, floor finish = 20 psf, f'_c = 3,000 psi, f_s=20,000 psi, f_y = 60,000 psi.

Follow the steps mentioned below in design calculation:

(i) Minimum slab thickness and load calculation
(ii) Determination of moment coefficient and calculation for design moments
(iii) Check for slab thickness to avoid compression failure of concrete
(iv) Calculation of reinforcements
(v) Check for temperature and shrinkage reinforcements
(vi) Design for corner reinforcements
(vii) Shoe layout of the reinforcements

Moment coefficients can be used from the attached tables.

1(b) 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 fourth 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 and make comments on the results. **(5)**

2 (a) Compare ordinary beam-girder floor and flat slab floor. **(5)**

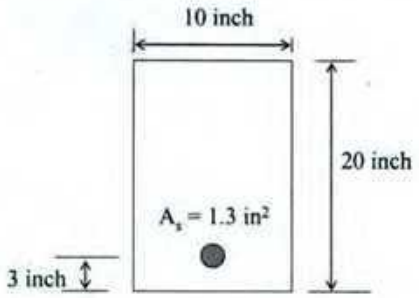
(b) A flat slab with drop panel and column capital is to be designed for a parking garage. Column capital is a 90° truncated cone with 4 ft diameter at the intersection of the capital with the bottom of the drop panel of size 7 ft by 7 ft. Columns are 22 ft center to center in each direction. Other design conditions and material properties are given below: **(20)**

LL = 200 psf, Allowable stress of steel = 20,000 psi, Ultimate strength of concrete = 3000 psi. Use WSD.
Follow the steps mentioned below in design calculation:
(i) Minimum slab thickness
(ii) Check for punching shear – around column capital
(iii) Check for punching shear – around drop panel
(iv) Check for beam shear
(v) Calculation for design moments

(v) Check for slab thickness – moment consideration
(vi) Calculation for reinforcements
(vii) Show layout of reinforcements

3 (a) Compare reinforced concrete and prestressed concrete taking into consideration sectional properties, material properties (concrete and steel), deflection of structure, and cracks in concrete. **(5)**

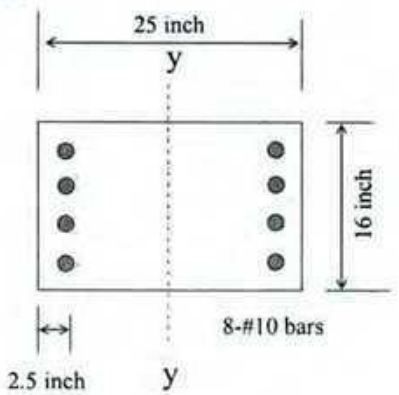
(b) Refer to the following section of a prestressed concrete simply-supported bridge girder of span 32 ft: **(20)**



Given, f_y = 224,000 psi, f_s' = 2,56,000 psi, $E_s = 27 \times 10^6$ psi, f'_c = 5000 psi, f_{se} = 1,40,000 psi.

Calculate (i) Allowable moment capacity and allowable superimposed load; and (ii) Ultimate moment capacity. Make comments on the results. Stress-strain diagram of the PC strands is attached.

4) Draw the interaction diagram of the following column section for bending about y-y axis. Use WSD and USD. **(25)**



Given, f'_c = 3 ksi, f_y = 40 ksi, f_s = 20 ksi.

5) A square footing is planned under a column with the following data: **(25)**

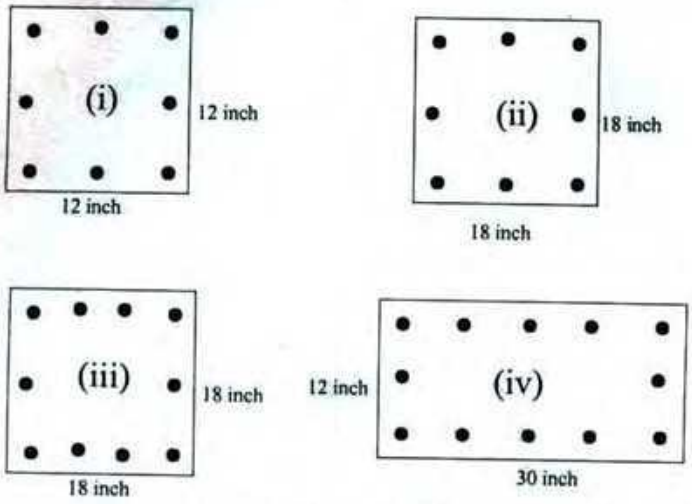
Column size = 18 inch by 18 inch, Column reinforcement = 8 - #8 bars
DL = 225 kips, LL = 175 kips, q_{all} = 5 ksf, f'_c = 4 ksi, and f_y = 50 ksi.

Design the footing by USD. Show all necessary calculations for the following steps:

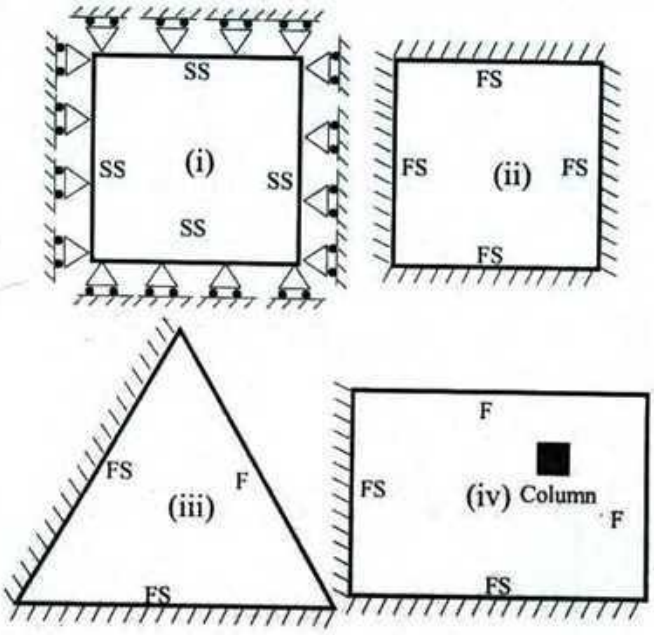
(i) Calculation of the bearing area (i.e. size of the footing)

(ii) Check for punching shear at possible locations
(iii) Check for beam shear
(iv) Calculation for moment and check for thickness for the maximum moment
(v) Calculation for reinforcement
(vi) Check for flexural bond stress
(vii) Design for dowels as per ACI guideline
(viii) Show layout of reinforcements

6 **(a)** Explain the ACI guideline for dowels at footing-column joint. **(4)**
(b) Explain the failure mechanism of tied and spiral column. **(5)**
(c) Draw the tie arrangement for the following column sections as per ACI code. **(8)**



(d) What do you mean by a yield line? Draw the possible yield lines for the following slabs: **(8)**



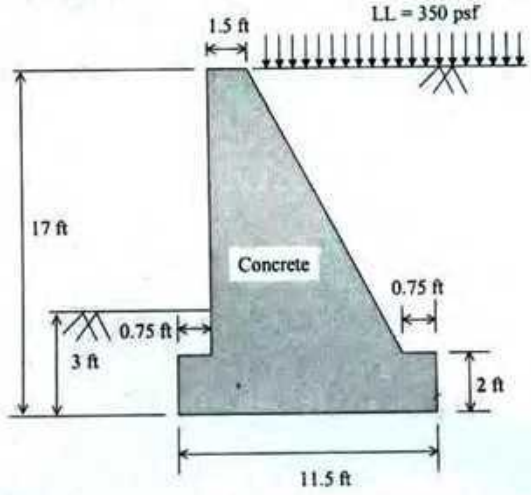
SS: Simply Support, FS: Fixed Support, F: Free

7 a) Draw the typical sections of (i) gravity retaining wall, (ii) cantilever retaining wall, and (iii) counterfort retaining wall. If the resultant reaction under a retaining wall is within the middle-third of the base, show that the pressure at the two edges of the base can be represented by the following equations: **(7)**

$$P_1 = (4l - 6a)\frac{R_v}{l^2} \text{ and } P_2 = (6a - 2l)\frac{R_v}{l^2}$$

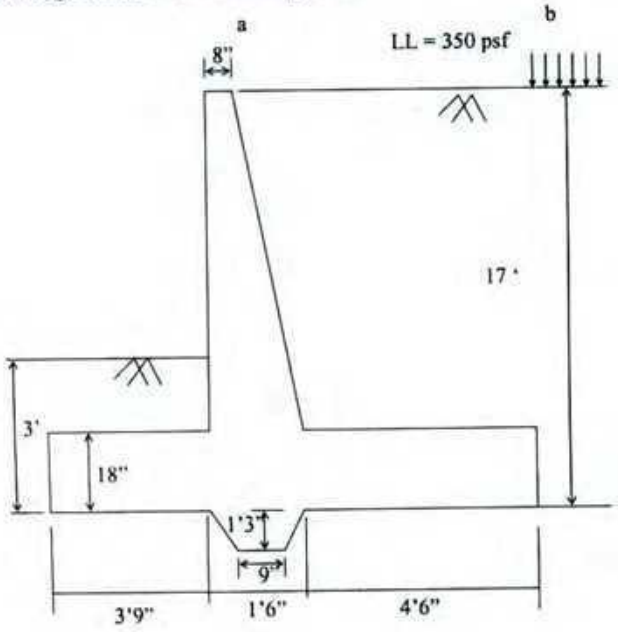
Symbols carry the usual meanings.

b) A trial 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. **(18)**



$\gamma_s = 120$ pcf, $\phi = 30$ degree, $f_{base} = 0.5$, Allowable bearing pressure = 4 tsf. Consider only the critical position of surcharge LL.

8) Refer to the following cantilever retaining wall. **(25)**



Consider LL can move to the line b as shown in the retaining wall. All preliminary dimensions of the wall are given in the figure. Design the wall by WSD. Follow the steps as mentioned below:

(i) Draw the lateral earth pressure diagram
(ii) Calculate moment and check for thickness of the arm at base
(iii) Check for stability against overturning
(iv) Check for bearing pressure under the base
(v) Check for stability against sliding
(vi) Design for arm and key
(vii) Design for base slab
(viii) Layout of the reinforcements

Given Parameters: $\gamma_s = 120$ pcf, $\phi = 30$ degree, $f_{base} = 0.5$, Allowable bearing pressure = 4 tsf.

Table 1 **Coefficients for negative moments in slabs***

$M_{A\,neg} = C_{A\,neg} \times w \times A^2$
$M_{B\,neg} = C_{B\,neg} \times w \times B^2$
where w = total uniform dead plus live load

Ratio $m = \frac{A}{B}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	$C_{A\,neg}$		0.045		0.050	0.075	0.071		0.033	0.061
	$C_{B\,neg}$		0.045	0.076	0.050			0.071	0.061	0.033
0.95	$C_{A\,neg}$		0.050		0.055	0.079	0.075		0.038	0.065
	$C_{B\,neg}$		0.041	0.072	0.045			0.067	0.056	0.029
0.90	$C_{A\,neg}$		0.055		0.060	0.080	0.079		0.043	0.068
	$C_{B\,neg}$		0.037	0.070	0.040			0.062	0.052	0.025
0.85	$C_{A\,neg}$		0.060		0.066	0.082	0.083		0.049	0.072
	$C_{B\,neg}$		0.031	0.065	0.034			0.057	0.046	0.021
0.80	$C_{A\,neg}$		0.065		0.071	0.083	0.086		0.055	0.075
	$C_{B\,neg}$		0.027	0.061	0.029			0.051	0.041	0.017
0.75	$C_{A\,neg}$		0.069		0.076	0.085	0.088		0.061	0.078
	$C_{B\,neg}$		0.022	0.056	0.024			0.044	0.036	0.014
0.70	$C_{A\,neg}$		0.074		0.081	0.086	0.091		0.068	0.081
	$C_{B\,neg}$		0.017	0.050	0.019			0.038	0.029	0.011
0.65	$C_{A\,neg}$		0.077		0.085	0.087	0.093		0.074	0.083
	$C_{B\,neg}$		0.014	0.043	0.015			0.031	0.024	0.008
0.60	$C_{A\,neg}$		0.081		0.089	0.088	0.095		0.080	0.085
	$C_{B\,neg}$		0.010	0.035	0.011			0.024	0.018	0.006
0.55	$C_{A\,neg}$		0.084		0.092	0.089	0.096		0.085	0.086
	$C_{B\,neg}$		0.007	0.028	0.008			0.019	0.014	0.005
0.50	$C_{A\,neg}$		0.086		0.094	0.090	0.097		0.089	0.088
	$C_{B\,neg}$		0.006	0.022	0.006			0.014	0.010	0.003

*A cross-hatched edge indicates that the slab continues across or is fixed at the support; an unmarked edge indicates a support at which torsional resistance is negligible.

Table 2 **Coefficients for dead-load positive moments in slabs***

$M_{A\,pos.\,DL} = C_{A\,DL} \times w \times A^2$
$M_{B\,pos.\,DL} = C_{B\,DL} \times w \times B^2$
where w = total uniform dead load

Ratio $m = \frac{A}{B}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	$C_{A\,DL}$	0.036	0.018	0.018	0.027	0.027	0.033	0.027	0.020	0.023
	$C_{B\,DL}$	0.036	0.018	0.027	0.027	0.018	0.027	0.033	0.023	0.020
0.95	$C_{A\,DL}$	0.040	0.020	0.021	0.030	0.028	0.036	0.031	0.022	0.024
	$C_{B\,DL}$	0.033	0.016	0.025	0.024	0.015	0.024	0.031	0.021	0.017
0.90	$C_{A\,DL}$	0.045	0.022	0.025	0.033	0.029	0.039	0.035	0.025	0.026
	$C_{B\,DL}$	0.029	0.014	0.024	0.022	0.013	0.021	0.028	0.019	0.015
0.85	$C_{A\,DL}$	0.050	0.024	0.029	0.036	0.031	0.042	0.040	0.029	0.028
	$C_{B\,DL}$	0.026	0.012	0.022	0.019	0.011	0.017	0.025	0.017	0.013
0.80	$C_{A\,DL}$	0.056	0.026	0.034	0.039	0.032	0.045	0.045	0.032	0.029
	$C_{B\,DL}$	0.023	0.011	0.020	0.016	0.009	0.015	0.022	0.015	0.010
0.75	$C_{A\,DL}$	0.061	0.028	0.040	0.043	0.033	0.048	0.051	0.036	0.031
	$C_{B\,DL}$	0.019	0.009	0.018	0.013	0.007	0.012	0.020	0.013	0.007
0.70	$C_{A\,DL}$	0.068	0.030	0.046	0.046	0.035	0.051	0.058	0.040	0.033
	$C_{B\,DL}$	0.016	0.007	0.016	0.011	0.005	0.009	0.017	0.011	0.006
0.65	$C_{A\,DL}$	0.074	0.032	0.054	0.050	0.036	0.054	0.065	0.044	0.034
	$C_{B\,DL}$	0.013	0.006	0.014	0.009	0.004	0.007	0.014	0.009	0.005
0.60	$C_{A\,DL}$	0.081	0.034	0.062	0.053	0.037	0.056	0.073	0.048	0.036
	$C_{B\,DL}$	0.010	0.004	0.011	0.007	0.003	0.006	0.012	0.007	0.004
0.55	$C_{A\,DL}$	0.088	0.035	0.071	0.056	0.038	0.058	0.081	0.052	0.037
	$C_{B\,DL}$	0.008	0.003	0.009	0.005	0.002	0.004	0.009	0.005	0.003
0.50	$C_{A\,DL}$	0.095	0.037	0.080	0.059	0.039	0.061	0.089	0.056	0.038
	$C_{B\,DL}$	0.006	0.002	0.007	0.004	0.001	0.003	0.007	0.004	0.002

*A cross-hatched edge indicates that the slab continues across or is fixed at the support; an unmarked edge indicates a support at which torsional resistance is negligible.

Table 3 **Coefficients for live-load positive moments in slabs***

$$M_{A\,pos,\,LL} = C_{A\,LL} \times w \times A^2$$
$$M_{B\,pos,\,LL} = C_{B\,LL} \times w \times B^2$$

where w = total uniform live load

Ratio $m = \frac{A}{B}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	$C_{A\,LL}$	0.036	0.027	0.027	0.032	0.032	0.035	0.032	0.028	0.030
	$C_{B\,LL}$	0.036	0.027	0.032	0.032	0.027	0.032	0.035	0.030	0.028
0.95	$C_{A\,LL}$	0.040	0.030	0.031	0.035	0.034	0.038	0.036	0.031	0.032
	$C_{B\,LL}$	0.033	0.025	0.029	0.029	0.024	0.029	0.032	0.027	0.025
0.90	$C_{A\,LL}$	0.045	0.034	0.035	0.039	0.037	0.042	0.040	0.035	0.036
	$C_{B\,LL}$	0.029	0.022	0.027	0.026	0.021	0.025	0.029	0.024	0.022
0.85	$C_{A\,LL}$	0.050	0.037	0.040	0.043	0.041	0.046	0.045	0.040	0.039
	$C_{B\,LL}$	0.026	0.019	0.024	0.023	0.019	0.022	0.026	0.022	0.020
0.80	$C_{A\,LL}$	0.056	0.041	0.045	0.048	0.044	0.051	0.051	0.044	0.042
	$C_{B\,LL}$	0.023	0.017	0.022	0.020	0.016	0.019	0.023	0.019	0.017
0.75	$C_{A\,LL}$	0.061	0.045	0.051	0.052	0.047	0.055	0.056	0.049	0.046
	$C_{B\,LL}$	0.019	0.014	0.019	0.016	0.013	0.016	0.020	0.016	0.013
0.70	$C_{A\,LL}$	0.068	0.049	0.057	0.057	0.051	0.060	0.063	0.054	0.050
	$C_{B\,LL}$	0.016	0.012	0.016	0.014	0.011	0.013	0.017	0.014	0.011
0.65	$C_{A\,LL}$	0.074	0.053	0.064	0.062	0.055	0.064	0.070	0.059	0.054
	$C_{B\,LL}$	0.013	0.010	0.014	0.011	0.009	0.010	0.014	0.011	0.009
0.60	$C_{A\,LL}$	0.081	0.058	0.071	0.067	0.059	0.068	0.077	0.065	0.059
	$C_{B\,LL}$	0.010	0.007	0.011	0.009	0.007	0.008	0.011	0.009	0.007
0.55	$C_{A\,LL}$	0.088	0.062	0.080	0.072	0.063	0.073	0.085	0.070	0.063
	$C_{B\,LL}$	0.008	0.006	0.009	0.007	0.005	0.006	0.009	0.007	0.006
0.50	$C_{A\,LL}$	0.095	0.066	0.088	0.077	0.067	0.078	0.092	0.076	0.067
	$C_{B\,LL}$	0.006	0.004	0.007	0.005	0.004	0.005	0.007	0.005	0.004

*A cross-hatched edge indicates that the slab continues across or is fixed at the support; an unmarked edge indicates a support at which torsional resistance is negligible.

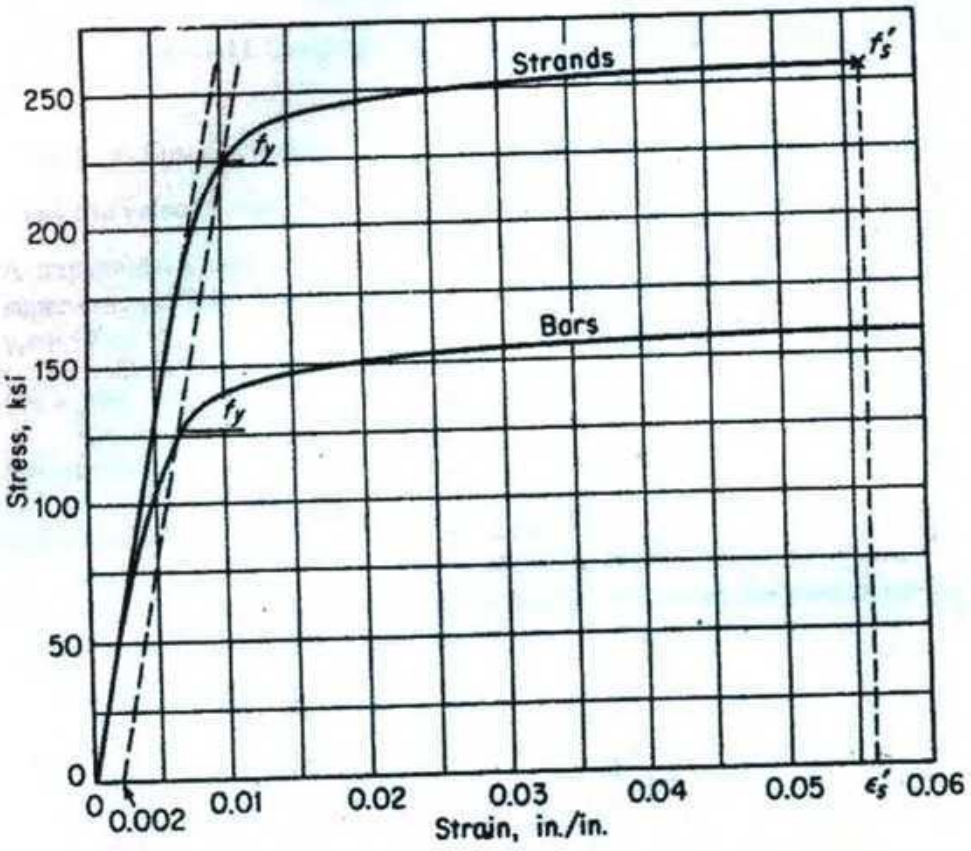


Fig. Stress-strain curves for prestressing steels.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering I Course Code: CE 331 Credit: 3.00
Time: 3 hours Full Marks: 100

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

1 a. The population in Dhaka city during the years 1996 to 2005 are shown below. Estimate the population in 2010 using least square parabola method. $8\frac{2}{3}$

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Population (million)	2.70	3.10	3.60	4.40	5.60	6.10	6.80	7.20	7.50	8.10

b. Briefly discuss the water demand of fire. 2

c. What are the essential elements for designing a water supply system for a city? 3

d. Do you think the water consumption of a family is directly related with their financial condition? If yes, explain why? 3

2 a. What factors should be considered in selection of site for pump station? 3

b. What are the advantages of providing gravel packing in the deep tube well. 2

c. Design a tube-well to deliver an average flow rate of 4.00×10^{-2} m^3/s at a depression head of 5 m. The average water level is 10 m below during dry season. The geological investigation have yielded the following results from site boring: $8\frac{2}{3}$

Depth	Type of Strata	K (mm/s)
0 to 5 m	Surface clay	0.002
5 to 20 m	Very fine sand	0.01
20 to 30 m	Clay	0.002
30 to 50 m	Coarse sand	1.50
Below 50	Clay	<0.02

Assume,

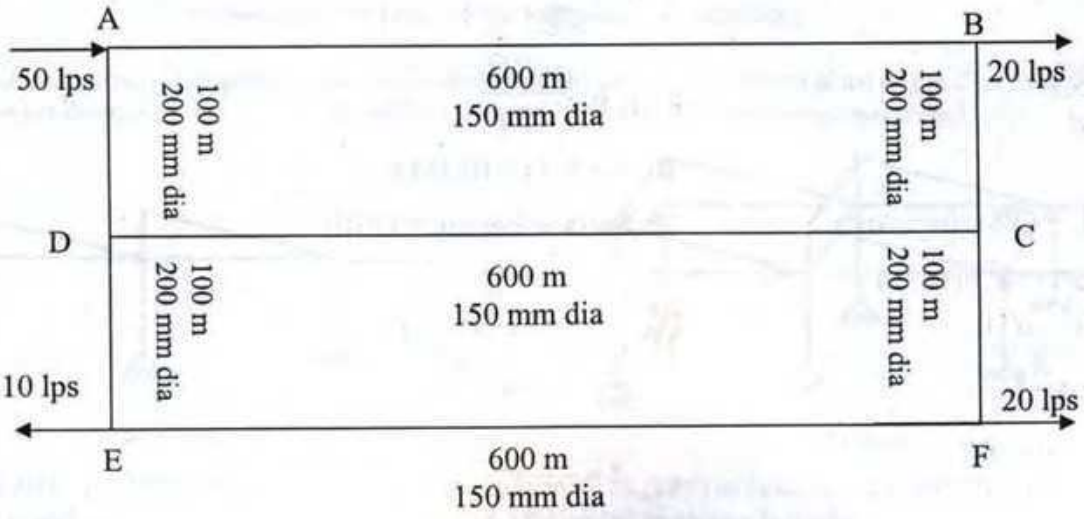
(i) Velocity of flow in the tube 2.5 m/s (ii) Pumping time = 10 hours daily
(iii) The maximum daily rate is 1.5 times the average daily rate
(iv) f=0.01 and efficiency 65% (v) Delivery head 10m

d. Briefly describe the technical advantages of "Tara Pump'. What is its primary limitation? 3

3	a.	Define with neat sketches Confined, Unconfined aquifers.	4
	b.	State Darcy Law.	2
	c.	Show that the ground water yield of an confined aquifer can be expressed as, $Q=\frac{2\pi Km(D-d)}{\log_e(\frac{R}{r})}$ Where, Q=flow rate, K= Hydraulic Conductivity, D-d=Drawdown R=Radius of influence, r= radius of well and m= aquifer depth	$6\frac{2}{3}$
	d.	The strainer of a 75 mm diameter tube well is sunk 40 m below static groundwater level and it fails 3 meter in the tube well while pumping. The radius of draw down is 30 m and the coefficient of permeability of the aquifer is 0.5 l/s/m^2. Calculate the probable discharge of the well.	4
4	a.	What are the objectives of water treatment?	2
	b.	Show with neat sketch the different components of a water treatment plant.	2
	c.	2500 m^3/day passes through a 6 m wide, 15 m long and 3 m deep sedimentation tank (a) Find the detention time for the basin? (b) If the wastewater contains 0.15 cm diameter suspended solids, What will be the settling velocity (ν=0.01m^2/s and S=2.65)? (c) What is the over flow rate? (d) What is the percentage removal of the particle in the tank?	$8\frac{2}{3}$
	d.	Explain the terms in brief (a) Coagulation (b) Disinfections	4
5	a.	What is polluted, contaminated and potable water?	3
	b.	What types of impurities may be present in water?	$2\frac{2}{3}$
	c.	Write a short note on water borne diseases.	3
	d.	What are the sources and environmental significances of the following water quality parameters, (i) Colour (ii) Total and Faecal Coliform (iii) Nitrate (iv) Arsenic	8
6	a.	What are the current major problems to deal with the water supply system in Dhaka city? Being a planner, develop at least two suggestions about how these might be improved.	4
	b.	Briefly discuss the tariff charges for water supply and sanitation services in Dhaka city.	$4\frac{2}{3}$
	c.	What are the present practices of water supply and system in the rural area of Bangladesh?	4
	d.	Brackish sea water may be an important water source for the coastal area of Bangladesh, give your opinion.	4
7	a.	What are the purposes of distribution system?	2
	b.	An elevated cylindrical water tank of 3650 m^3 capacity has to be designed for water supply system for a locality. If concrete work per square meter in the floor and wall of shell costs Tk.500.00 and Tk.750.00 respectively, what would be the most economical radius and height of the storage tank?	$8\frac{2}{3}$
	c.	Describe with neat sketches the various layouts of distribution network in a water supply system and state their advantages and disadvantages.	6

8 a. Discuss various methods of distributing water and discuss the advantages and disadvantages of each. 4

b. Calculate the flow in each of the pipes in the following looped pipe network. Use head loss determination diagram given below and show at least two trials. $12\frac{2}{3}$



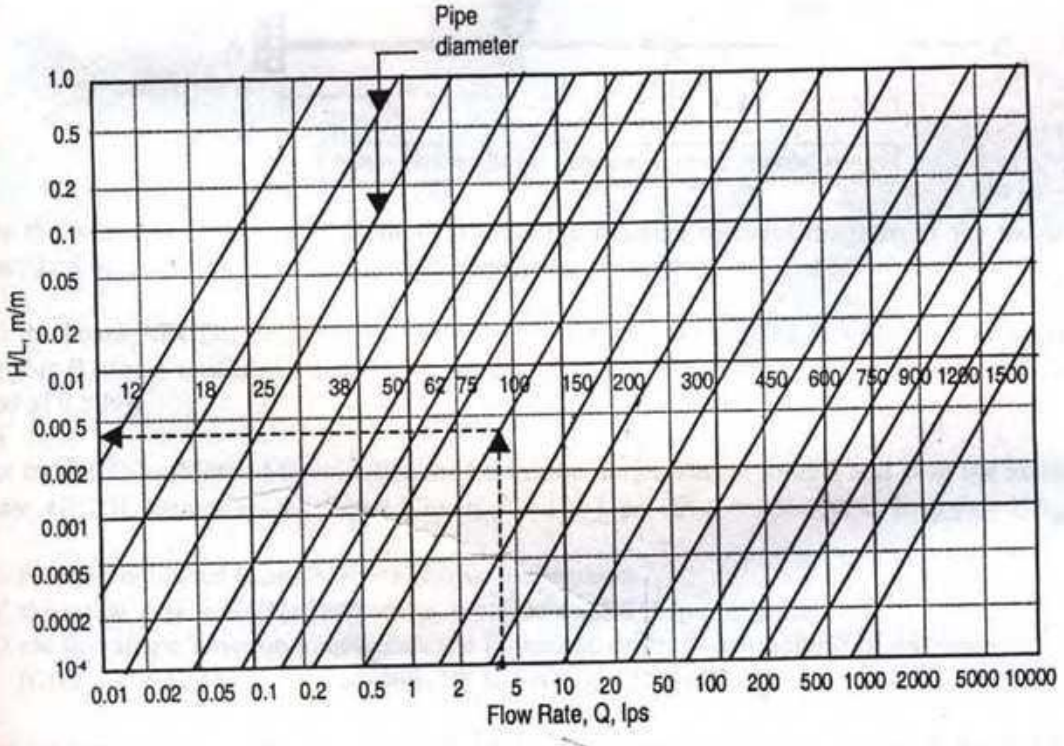


Figure: Head loss determination diagram (for C=120)

FORMULAE:

1. $Y = a + bX + cX^2$
2. $\sum Y = aN + b\sum X + c\sum X^2$
3. $\sum XY = a\sum X + b\sum X^2 + c\sum X^3$
4. $\sum X^2Y = a\sum X^2 + b\sum X^3 + c\sum X^4$
5. $H = h_e + h_f + h_v$
6. $h_v = \frac{V^2}{2g}$
7. $h_f = \frac{4flv^2}{2gd}$
8. $H.P = \frac{wQH}{75\eta}$
9. $V_0 = H/T$
10. $T = V/Q = BLH/Q$
11. $V_0 = Q/BL = Q/\text{Surface Area}$
12. Surface loading $= Q/BL$
13. $Vs = g * (S-1) * d^2 / (18 * \nu)$
14. $Q = \frac{\pi K(D^2 - d^2)}{\log_e(\frac{R}{r})}$
15. $Q = \frac{2\pi Km(D-d)}{\log_e(\frac{R}{r})}$
16. $\frac{H}{L} = \frac{1.59 \times 10^6 Q^{1.85}}{D^{4.87}}$
17. $\Delta = -\frac{\sum H}{1.85\sum \frac{H}{Q_a}}$

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall-2007
Program: B.Sc Engineering (Civil)

Course # CE 351 Course Title: Transportation Engineering I: Transport & Traffic Design
Full Marks: 150 Time : 3 hrs

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) Why is Transportation Engineering so essential now-a-days? (5)
   (b) Write down the names of different ministries involved in the transportation control and management system in Bangladesh. (9)
   (c) Write a short note on design designation of a highway. (3)
   (d) A minus 3.8% grade intersects a plus 6.3% grade at station 250 + 75 and an elevation of 630.0 ft.Calculate the vertical elevations at station 248 + 50 and 255 + 00 for 775 ft vertical curve. (8)

2. (a) Write a short note on Level-of-service. (6)
   (b) What are the different functions of a shoulder? (6)
   (c) What are the objectives of origin and destination survey? (3)
   (d) What are the factors affecting the development of transportation system? (10)

3. (a) What are the general requirements of traffic control devices? (5)
   (b) What are the advantages and disadvantages of rotary intersection? (8)
   (c) Design a two-phase signal of an isolated cross-junction from the following data. (12)

Amber	3 sec
Red-amber	2 sec

	N – S	E – W
Inter-green (sec)	9	7
Lost time (sec)	3	2

	N	S	E	W
Arrival flow (PCU/hr)	750	550	600	700
Saturation flow (PCU/hr)	2000	1950	1800	1800

4. (a) Write a short note on- "Limited access of highway". (4)
   (b) Classify and describe traffic signs according to function. (10)
   (c) What are the different requirements of terminals? Where is adequate street lighting required? (6)
   (d) What are the different methods of speed measurement? (5)

SECTION B

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

5. (a) What are the objectives of Delay studies? Where should parking be prohibited? (6)
   (b) Calculate super elevation rate for a roadway with a design speed of 75 mph and a degree of curve 4^0, Assume f = 0.11. (9)
   (c) Briefly explain the different government on transport planning policies in Bangladesh? (10)

6. (a) What is transition curve? Draw diagrammatic profile of attaining super elevation (pavement revolved about center line). (8)
   (b) Discuss briefly the various modes of transport. (12)
   (c) Write a short note on pavement crown. (5)

7. (a) Draw a typical simple highway curve. (3)
   (b) Classify and define the new road classification in Bangladesh. (8)
   (c) A new commercial building is expected to add 1500 pedestrians to an 15 ft sidewalk during the peak 12 min period. The sidewalk already has a flow of 1700 pedestrians during the peak period. Characterize the quality of flow. What is the minimum width of sidewalk for commercial areas? (9)
   (d) What are the structural and physical weaknesses of Bangladesh Railways? (5)

8. (a) What do you mean by PCE? (5)
   (b) Define the followings: (10)
   (i) Volume/flow, (ii) Design vehicle (iii) Average Daily traffic, (iv) Median ,
   (v) Vertical curve
   (c) Write short note on minimum passing sight distance. What are the different controls and criteria in geometric design? (10)

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall- 2007
Program: B.Sc. Engineering (Civil)

Course Title: Open Channel Flow Course Code: CE 361 Credit: 3.00
Time: 3 hours Full Marks: 100

Answer any **SIX** out of **EIGHT** Questions. The figures in the right margin indicate full marks.

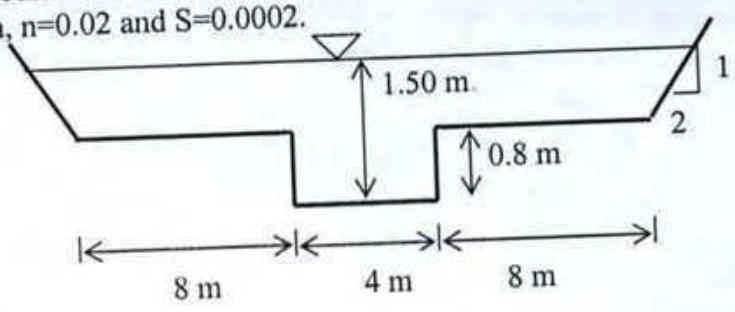
1 a. Define: (a) Froude Number, and (b) Reynolds Number 4

b. Why the velocity distribution in open channel flows is not uniform? 4

c. A trapezoidal channel has a bottom width of 6.0 m, side slope of 2:1. Find the possible super-critical flow depth when the flow is 50 m^3/s and Energy 5.25 m. (critical depth, y_c=1.59 m) 4

d. Show that the critical depth (y_c) and velocity (V_c) for a rectangular channel can be expressed by $y_c = \sqrt[3]{\frac{q^2}{g}}$ and $V_c = \sqrt[3]{qg}$ respectively, where 'q' is the discharge per unit width and 'g' is the acceleration due to gravity. $4\frac{2}{3}$

2 a. For the compound channel shown in figure, determine the discharge for a depth of flow 1.50 m. Given, n=0.02 and S=0.0002. $4\frac{2}{3}$



b. A trapezoidal channel has a bottom width of 8.0 m, side slopes of 2:1, and n=0.025. 6
(a) Determine the normal slope at a normal depth of 1.50 m when the discharge is 15 m^3/s.
(b) Determine the critical slope and the corresponding normal depth when the discharge is 15 m^3/s.

c. What do you mean by (a) a channel section with composite roughness, and (b) the conveyance of a channel section. 6

3 a. Explain why a uniform flow cannot occur (a) in a frictionless channel (b) in a horizontal channel, and (c) channel with adverse slope 3

b. Mention the factors that affect Manning's roughness coefficient. $4\frac{2}{3}$

c. A concrete lined trapezoidal channel (n=0.015) is 8.0 m wide and has a side slope of 2H:1V. The longitudinal slope is 0.006. Estimate the normal depth in this channel for a discharge of 52.50 m^3/s. 6

d. An earthen trapezoidal channel (n=0.025) has a bottom width of 6.0 m, side slope of 2.0 H : 1 V and a uniform flow depth of 1.5 m. It is observed from an economic study that seepage is minimum when canal sides are lined only with smooth concrete (n = 0.015), determine the equivalent roughness of the channel. 3

4 a. Briefly discuss the practical applications of hydraulic jump. 3

b. Draw typical velocity distribution curve at a section in hydraulic jump. 2

c. Explain with neat sketches various types of hydraulic jumps. $6\frac{2}{3}$

d. A horizontal rectangular channel carrying 11.0 m^3/s per metre width at a depth of 0.7 m. At a certain section a hydraulic jump is formed. Calculate the sequent depth, length of the jump and energy loss in the jump. 5

5 a. A broad crested weir with an upstream square corner and spanning the full width of a rectangular canal of width 2.5 m is planned. The proposed crest length is 4.00 m and the crest elevation is 1.25 m above the bed. Calculate the water surface elevation upstream of the weir when the discharge is 5.0 m^3/s. $6\frac{2}{3}$

b. A right angled triangular notch discharges under free-flow conditions. Estimate the discharge if the heights of water surface measured above the vertex of the notch is 0.50 m. (Assume C_d=0.7) 3

c. Water flows at a depth of 2.0 m and a velocity of 1.5 m/s in a 4.0 m wide rectangular channel. Find (i) the height of hump required to produce critical flow without affecting the upstream depth and (ii) the depth over the hump when the height of the hump is half the above value. 7

6 a. What do you mean by best hydraulic section? Using the best hydraulic section concept show that the hydraulic radius of a trapezoidal channel is half of the depth of flow. $6\frac{2}{3}$

b. A trapezoidal section is to be built of rough un-sized timber (n=0.011) with a drop of 2 m in a km. What will be the depth of water for most efficient section for a flow of 1.1 m^3/s? 2

c. Design a stable canal using Kennedy's equation to carry a discharge of 15 m^3/s at a slope of 2×10^{-4}. Given, n = 0.025 and m=0.90. 4

d. Design a trapezoidal (z=0.5) regime channel to carry 10 m^3/s using Lacey's equation. Mean sediment size of the sand is 0.5 mm. 4

7. a. What is free board? What are the purposes of providing free board? 2

b. What are the reasons for lining channels? 2

c. Define (a) Tractive force, and (b) Regime Channel 4

d. Design a canal to carry 50.00 m^3/s of clear water through 4.0 mm gravel (manning's roughness coefficient =0.0148 and angle of Repose 37°) on a slope of 10^{-4}. The canal is to be trapezoidal in shape having side slopes of 1.5 H: 1 V. The average temperature = 20°c for which $\nu = 10^{-6}\ m^2/s$ and $\rho_s = 2.65$. $8\frac{2}{3}$

8 a. Mention whether the statement is **TRUE** or **FALSE**. 10

(i) Zone 3 represents the space above the upper line

(ii) In the differential equation of GVF, $\frac{dy}{dx}$ represents the water-surface slope relative to the bottom of the channel.

(iii) Flow profile with $\frac{dy}{dx}$ = +Ve represents a drawdown curve.

(iv) $y_n < y_c$ is the condition for Steep Slope.

(v) M_3 flow profile represents sub-critical state of flow.

(vi) H_2 flow profile is not possible

(vii) C_1 and C_3 Profile are very rare and are highly unstable.

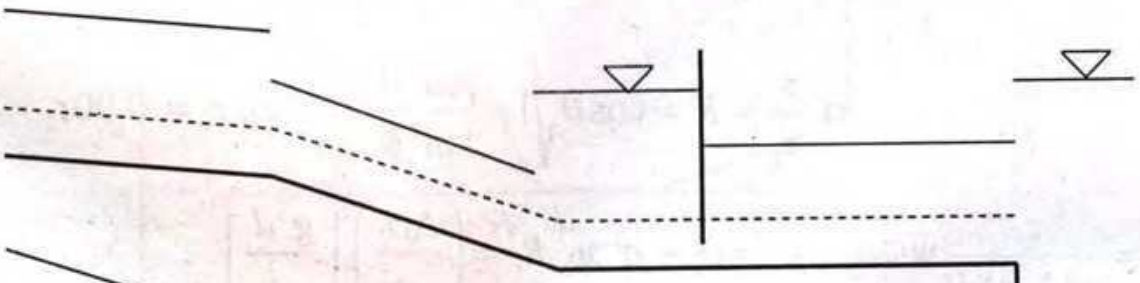
(viii) A control section is defined as a section in which a fixed relationship exists between the velocity and depth of flow.

(ix) Hydraulic jump is created when flow condition changes from sub-critical to super critical state.

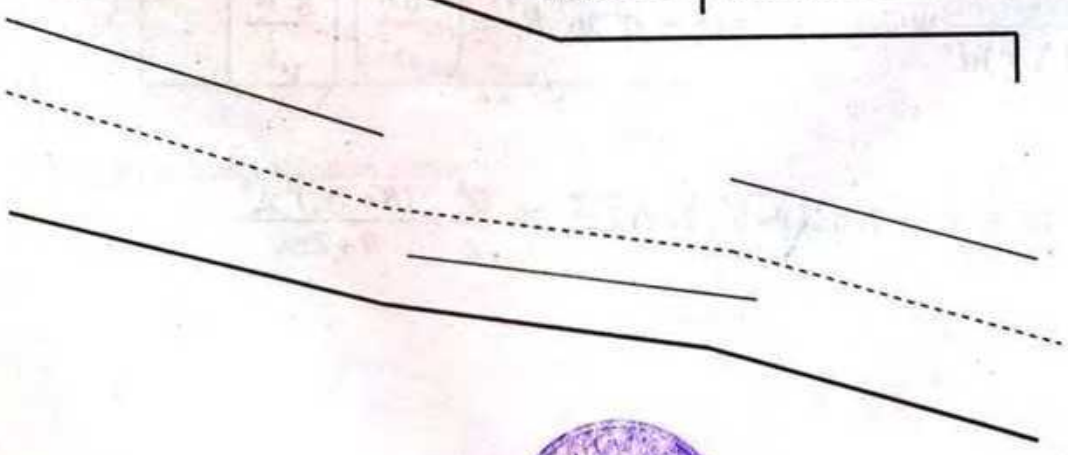
(x) S_3 flow generates from a sluice gate with a steep slope with free flow condition.

b. Sketch the possible flow profiles (at least one for each figure) for the following two figures $6\frac{2}{3}$

(i) y_n ——— y_c ----------



(ii)



FORMULAE

1. $\alpha = \frac{\int v^3 dA}{V^3 A}$ 2. $\beta = \frac{\sum v^2 \Delta A}{V^2 A}$ 3. $u = \frac{\int u.dy}{y}$ 4. $P = \gamma h$

5. , $h = h_s + c$ or, $h = h_s - c$ 6. $c = \frac{d}{g}\frac{v^2}{r}$ 7. $\left(\frac{P}{\gamma} + Z\right) = \int \frac{V^2}{gr} dr + cons\tan t$

8. $a_n = \frac{v^2}{r}$ 9. $\frac{y_2}{y_1} = \frac{1}{2}(\sqrt{1+8F_1^2} - 1)$ or, $\frac{y_1}{y_2} = \frac{1}{2}(\sqrt{1+8F_2^2} - 1)$

10. $\Delta E = E_1 - E_2$ 11. $\Delta E = \frac{(y_2 - y_1)^3}{4 y_1 y_2}$ 12. $\frac{L_j}{y_1} = 9.75(F_1 - 1)^{1.01}$

13. $E_2 = E_1 - \Delta Z_1$ 14. $\frac{V_c^2}{2g} = \frac{y_c}{2}$, $E_c = \frac{3y_c}{2}$; $y_c = \left(\frac{q^2}{g}\right)^{\frac{1}{3}}$

15. $Q = \frac{2}{3} C_d \sqrt{2g} L H_1^{\frac{3}{2}}$ 16. $C_d = 0.611 + 0.08(H_1/P)$ which is valid for $H_1/P \leq 5.0$

17. For long weirs, $H_1/B_w \leq 0.1$, $C_d = 0.561(H_1/B_w)^{0.022}$

For broad crested weirs, $0.1 \leq H_1/B_w \leq 0.35$, $C_d = 0.028(H_1/B_w) + 0.521$

For narrow crested weirs, $0.45 \leq H_1/B_w \leq 1.5$, $C_d = 0.120(H_1/B_w) + 0.492$

18. $Q = \frac{8}{15} C_d \sqrt{2g} \tan\theta H_1^{\frac{3}{2}}$ 19. $V = \frac{1}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$ 20. $n = \frac{d_{50}^{\frac{1}{6}}}{21.1}$ 21. $n = \frac{d_{90}^{\frac{1}{6}}}{26}$

22. $n_{eq} = \frac{(\sum n_i^{\frac{3}{2}} P_i)^{\frac{2}{3}}}{P^{\frac{2}{3}}}$ 23. $\frac{\tau_s}{\tau_b} = K = \cos\theta \sqrt{1 - \frac{\tan^2\theta}{\tan^2\phi}}$ 24. $\tau_b = 0.90\tau_c$

25. $\tau_c^* = \frac{\tau_c}{g(\Delta\rho_s)d}$ Where, $\Delta\rho_s = \rho_s - \rho$ 26. $R_1^* = \left(\frac{\Delta\rho_s}{\rho}\right)^{\frac{1}{3}} \left(\frac{g^{\frac{1}{3}} d}{\nu^{\frac{2}{3}}}\right)$

27. $\tau_{bm} \leq \tau_b$, $\tau_{sm} \leq \tau_s$ 28. $A = (b + zy)y$ and $P = b + 2y\sqrt{1+z^2}$ 29. $\frac{Q^2}{g} = \frac{(B + zy_c)^3 y_c^3}{B + 2zy_c}$

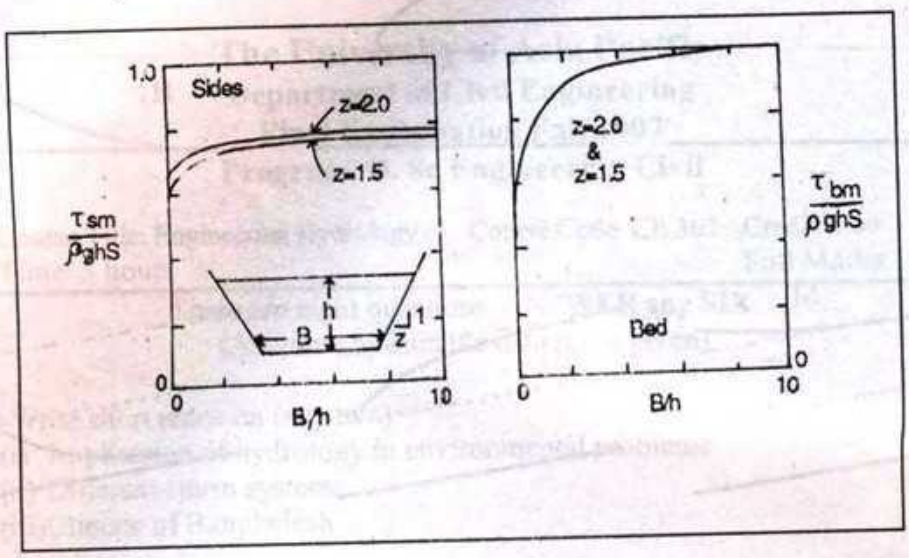


Figure: Maximum shear stresses on bed and sides of smooth trapezoidal channels

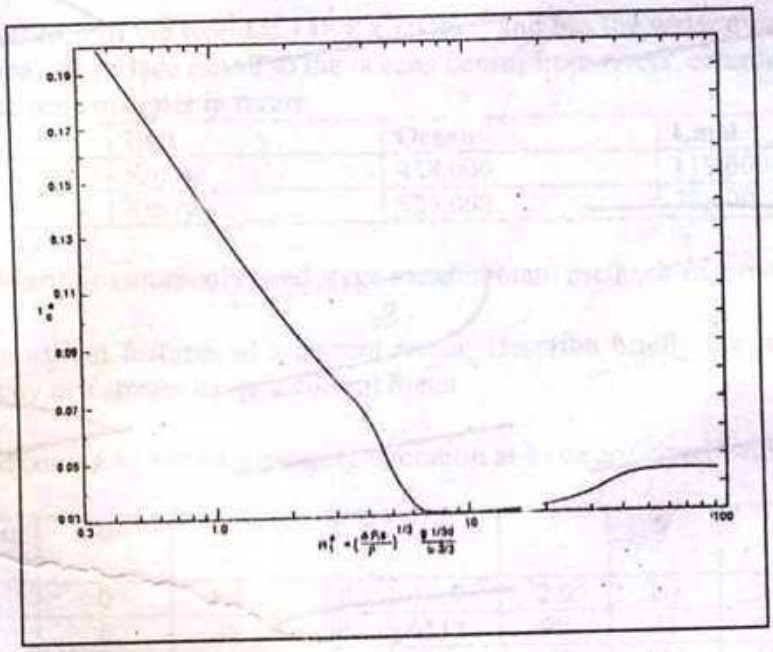
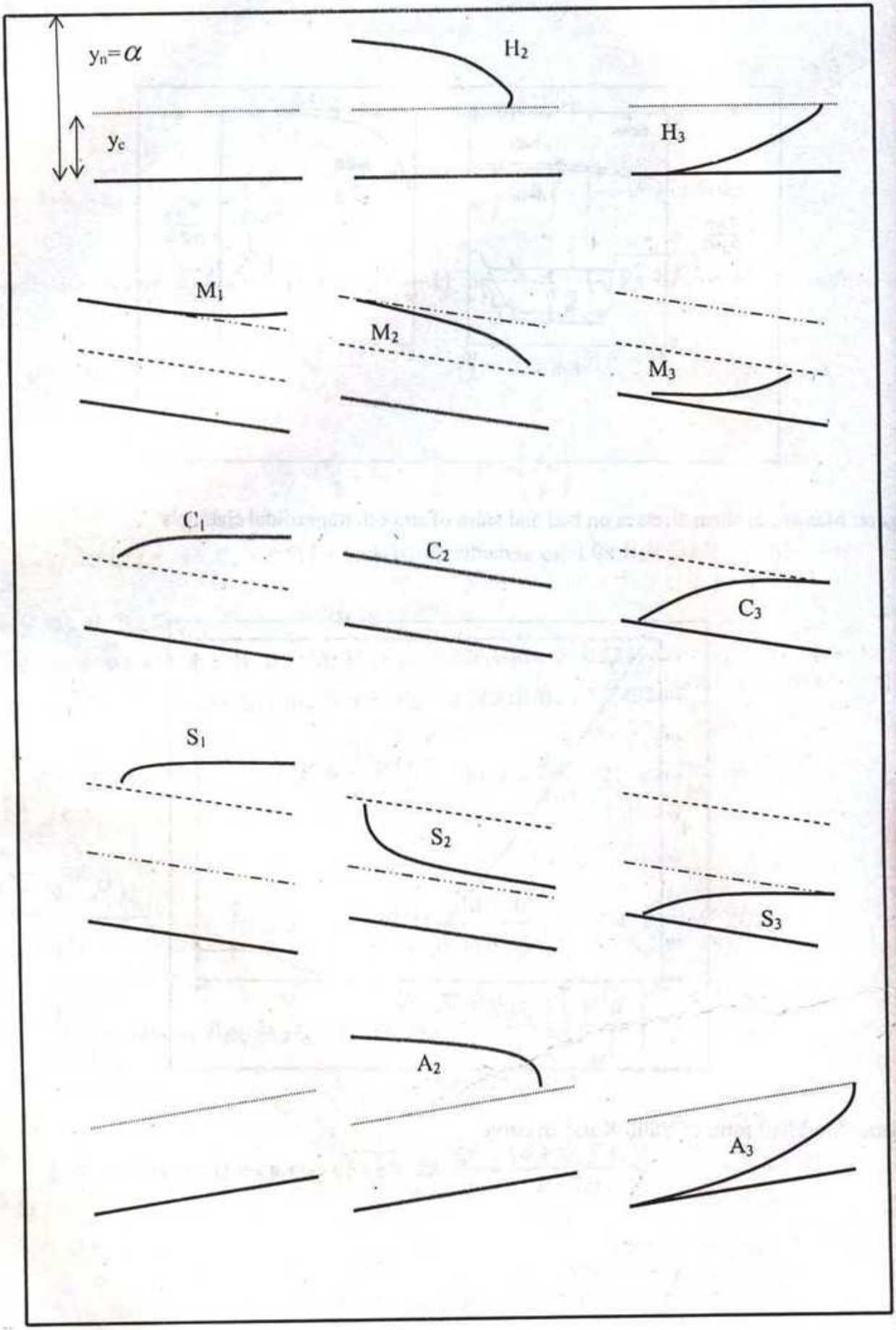


Figure: Modified form of Yalin-Karahan curve


$y_n=\alpha$
y_c
H_2
H_3
M_1
M_2
M_3
C_1
C_2
C_3
S_1
S_2
S_3
A_2
A_3

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B. Sc Engineering Civil

Course Title: Engineering Hydrology Course Code: CE 363 Credit: 3.00
Time: 3 hours Full Marks:150

There are eight questions. **ANSWER** any **SIX**.
(Assume any suitable data if not given)

1(a) Write short notes on (any two): (8)
(i) Application of hydrology in environmental problems
(ii) Different storm systems
(iii)Climate of Bangladesh

1(b) In a diagram show (any two): (8)
(i) How water droplets in clouds form by nucleation
(ii) Life cycle of a frontal cyclone
(iii)Longitudinal cross section of the general atmospheric circulation

1(c) The total river area of the world is 148.8×10^6 km^2 and has the water quantity 2,120 km^3. Assuming that all surface runoff to the oceans comes from rivers, calculate the average residence time of water in rivers. (9)

	Unit	Ocean	Land
Precipitation	Km^3/yr	458,000	119,000
Evaporation	Km^3/yr	505,000	72,000

2(a) Explain the various commonly used stage measurement methods in a river. (5)

2(b) Explain the salient features of a current meter. Describe briefly the procedure of measuring velocity in a stream using a current meter. (8)

2(c) The data pertaining to a stream gauging operation at a site are given below:

Distance from left edge (m)	0	1	3	5	7	9	11	12
Depth (m)	0	1.1	2.0	2.5	2.0	1.7	1.0	0
Revolution	0	39	58	112	90	45	30	0
Duration of observation(s)	0	100	100	150	150	100	100	0

The current meter was placed at 0.6 times of water depths. The rating equation of velocity is $v = 0.51\ N + 0.03$ m/s, where N is the revolution per second. Find the discharge of the stream. (12)

3(a) Explain the procedure for (7)
(i) Checking a rainfall data consistency
(ii) Supplementing the missing data

3(b) In a catchment area, approximated by a square of side length 100 km, four rainfall stations are situated inside the catchment and one station is outside. The coordinate of the center of the catchment is (100, 100). Determine the average rainfall using the Thiessen method. (18)

Station	1	2	3	4	5
Coordinates	(70, 100)	(100, 70)	(130, 100)	(100, 140)	(70, 170)
Rainfall (cm)	85	135	95	146	102

4(a) Distinguish between (i) Infitration capacity & Infiltration rate (ii) Actual and Potential evapotranspiration (iii) Field Capacity (FC) and Permanent Wilting Point (PWP). (9)

4(b) List the various parameters that are needed to use Penman's equation for estimating the potential evapotranspiration from a given area. (4)

4(c) A reservoir with a surface area of 300 hectares had the following average values of parameters during a week: Water temperature = 25° C, relative humidity = 40% wind velocity at 1.0m above ground level = 16 km/h. Estimate the average daily evaporation from the lake. Assume saturated vapour pressure, e_w = 17.54 mm of Hg. (12)

5(a) Draw a figure showing the element of a runoff hydrograph and describe the characteristics of the recession limb. Describe the methods of base flow separation. (10)

5(b) Construct a stream flow hydrograph due to a 6-h rainfall over a 104 km^2 drainage area and derive a unit hydrograph from it. Plot the stream flow hydrograph and the unit hydrograph. (15)

Date	Hours	Total flow (m^3/s)	Base flow (m^3/s)
Feb 16	0600	11	11
	0800	170	8
	1000	260	6
	1200	266	6
	1400	226	8
	1600	188	9
	1800	157	11
	2000	130	12
	2200	108	14
	2400	91	15
Feb 17	0200	76	17
	0400	64	19
	0600	54	21
	0800	46	22
	1000	38	24
	1200	32	26
	1400	27	27

6(a) Explain the methods of obtaining unit hydrograph of different durations. (5)

6(b) Given below is 12-h unit hydrograph. Construct the 12-h S-curve and obtain a 6-h unit hydrograph using the S-curve. (10)

Time (h)	0	12	24	36	48	60	72	84	96	108	120
Flow (m^3/s)	0	103	279	165	78	36	20	11	5	3	0

6(c) A basin has 400 sq. km of area, L = 35 km and L_{ca} = 10 km. Assuming C_t=1.5 and C_p = 0.7 develop a 3-h synthetic unit hydrograph for this basin using snyder's method. (10)

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

7(b) Describe prism and wedge storage in a channel and also describe the role of 'x' in the Muskingum equation for channel routing. (5)

7(c) Observed values of inflow and outflow hydrographs at the ends of a reach in a river are given below. Determine the best of 'k' and 'x' values to be used in the Muskingum method of flood routing. (15)

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66
Inflow (m^3/s)	20	80	210	240	215	170	130	90	60	40	28	16
Outflow (m^3/s)	20	20	50	150	200	210	185	155	120	85	55	23

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

Year	1987	1988	1989	1990	1991	1992	1993
Flood flow (m^3/s)	3210	4000	1250	3300	2480	1780	1860

Year	1994	1995	1996	1997	1998	1999
Flood flow (m^3/s)	4130	3110	2320	2480	3405	1820

8(b) What are the 95% confidence limits for the estimated flood peaks in 8(a). (10)

Table of normal variates:

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

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

N = sample size

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

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

N = sample size

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

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007

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

There are **7 (seven)** questions. Answer **any 5 (five)**

Q. 1. (a) Briefly describe the three different stages of effective planning. (8)
(b) What do you mean by Work Breakdown Structure? Discuss. (6)
(c) Write down the main causes of accidents in construction works. (6)

Q. 2. (a) Briefly explain any five major elements of Project Planning. (8)
(b) Why project manager is often termed as "Conflict Manager" – discuss. (6)
(c) Do you think meaningful conflict is beneficial to the project organization? If no, why? If yes, how can it be beneficial? Explain. (6)

Q. 3. (a) What problems PM usually faces in allocating resources? (4)
(b) Elaborate how to collect data in monitoring a project. (7)
(c) For the following task table, draw the AON network diagram, find critical path and calculate total duration of the project as well as slack time for each element. (9)

Task	Predecessor	Duration (days)
A	------	5
B	A	4
C	A	6
D	B	8
E	C	5
F	D, E	9
G	F	3
H	F	7

Q. 4. (a) Elaborate how to collect data in monitoring a project. (7)
(b) What are the consequences of poor project planning? (4)
(c) Explain 3 different types of cybernetic control system. (9)

Q. 5. (a) What are the benefits and limitations of GANTT chart over Network? Out of these two, which one do you think easier to understand for the workers? Justify your answer. (6)

(b) What are the basic reasons for crashing a project? (4)

(c) For the following task table, find different possible crash time and corresponding costs for the project. (10)

Activity	Predecessor	Duration (days)		Cost (Taka)	
		Normal	Crash	Normal	Crash
a	----	3	3	40	40
b	a	3	2	20	50
c	a	3	3	20	20
d	a	4	2	50	110
e	b	3	1	10	50

Q. 6. (a) Name three mechanisms in controlling a project. (3)

(b) Explain different contract styles in construction management. (9)

(c) Write short notes on: (4 + 4)

I. Physical asset control

II. Human resources control

Q. 7. (a) How can you distinguish partnering from chartering in negotiation? (5)

(b) What do you mean by win-win situation in conflict negotiation. (3)

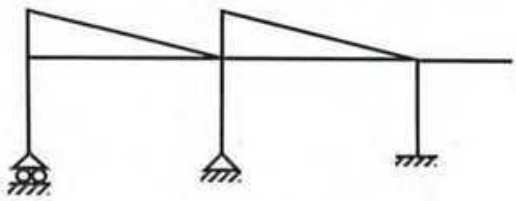
(c) A student in a college realizes that "all study and no play" will make him a dull boy. As a result, he wants to apportion his available time of about 10 hours a day between work and play. He estimates that play is twice as much fun as work. He also wants to study at least as much as he plays. However, he realizes that if he is going to get all his assignment done, he cannot play more than 4 hours a day. Using graphical method, how should he allocate his time to maximize his pleasure from both work and play? (12)

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007

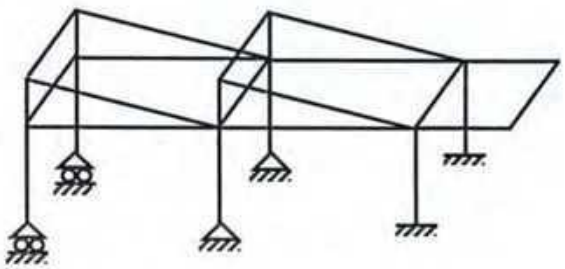
Course #: CE 411 — Course Title: Structural Analysis & Design III
Full Marks: 100 (= 10 × 10) — Time: 3 hours

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

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

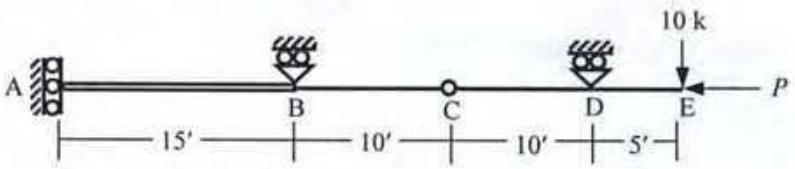


2D Frame



3D Frame

2. Use the Stiffness Method (considering flexural deformations only) to calculate the vertical deflection at joint A and rotation at joint B of the beam ABCDE loaded as shown below
[Given: $P = 0$, $EI_{AB} = 40\times10^3$ k-ft^2, $EI_{BCDE} = EI_{AB}/2$].



A is a Guided Roller support, C in an Internal Hinge

3. Use the Moment Distribution Method to draw the bending moment diagram of the beam ABCDE described in Question 2 (*Extend the structure using symmetry*).

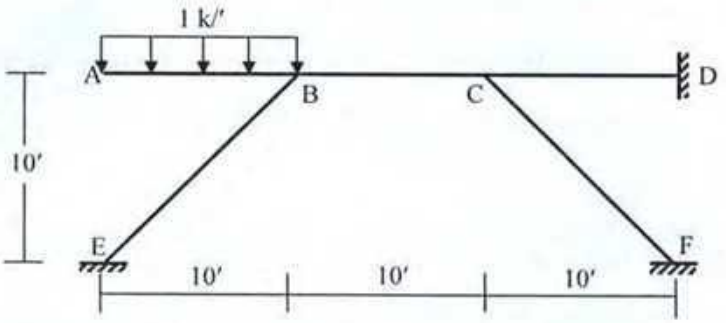
4. For the beam ABCDE described in Question 2, calculate the maximum value of R_B (the reaction at support B) for a uniformly distributed dead load of 1 k/ft and a moving uniformly distributed live load of 0.5 k/ft.

5. Use the Stiffness Method to calculate the horizontal deflections at joint B and D of the axially loaded beam ABCDE shown in Question 2 [Given: $P = 100$ kips, $EA_{AB} = 400\times10^3$ k, $EA_{BCDE} = EA_{AB}/2$].

6. For the axially loaded beam ABCDE shown in Question 2,
   (i) show that $\phi(x) = x/40$ [$x_A = 0$ and $x_E = 40'$] is a valid shape function,
   (ii) use this shape function to calculate the horizontal deflection at point E of the beam
   [Given: $P = 100$ kips, $EA_{AB} = 400\times10^3$ k, $EA_{BCDE} = EA_{AB}/2$].

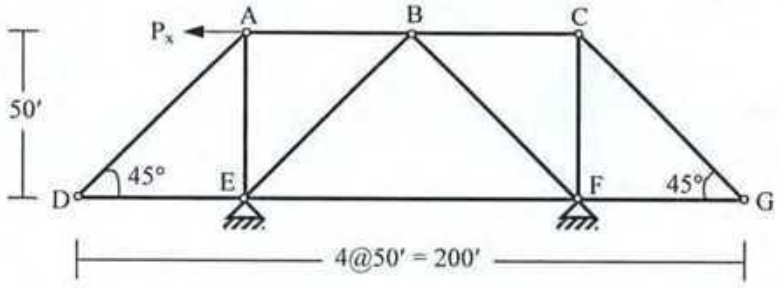
7. Use the Stiffness Method to calculate the value of the force P to cause buckling of the beam ABCDE shown in Question 2.

8. Use the Stiffness Method (with flexural deformations only) to calculate the rotations at joint B and joint C of the frame shown below if, in addition to the applied load, support D settles 0.10′ downward [Given: EI = constant = 40×10^3 k-ft^2].



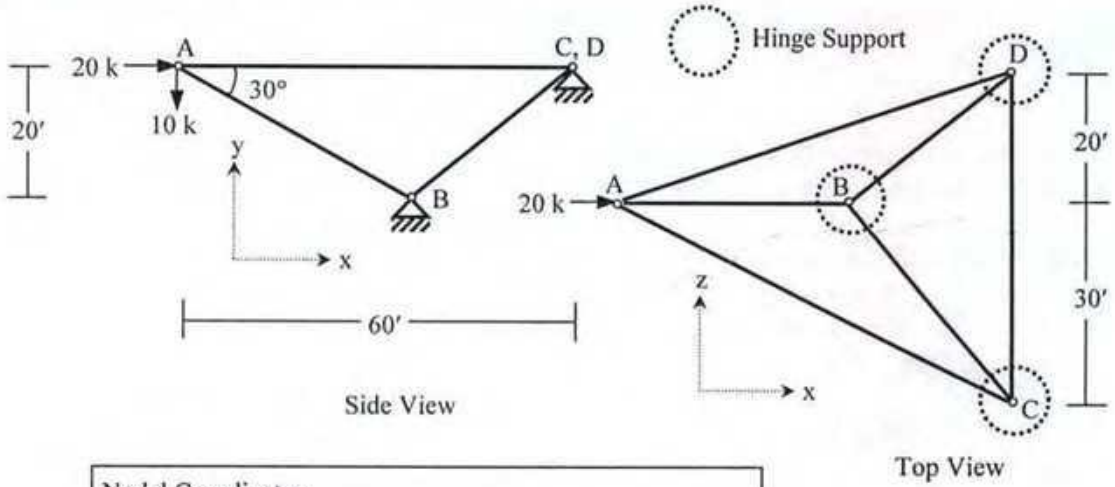
9. Use the Moment Distribution Method to draw the bending moment diagram of the frame described in Question 8.

10. In the truss shown below, ignore the zero-force members and formulate the stiffness matrix, load vector and write down the boundary conditions [Given: EA/L = constant = 500 kip/ft].



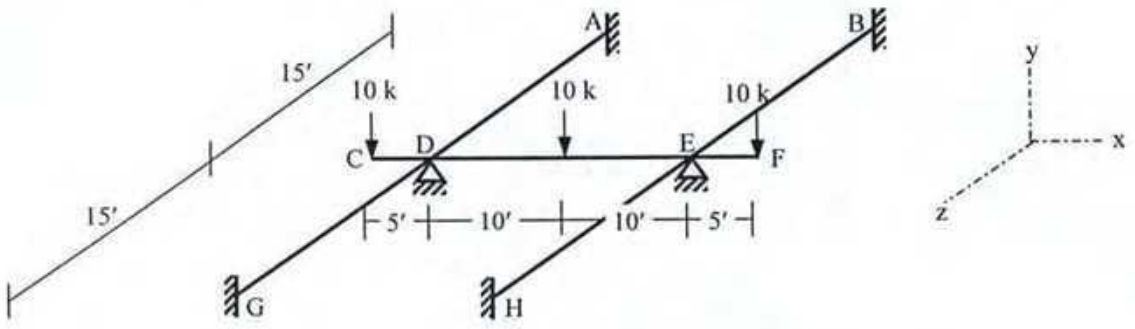
11. For the truss described in Question 10, the force in member BF is 10 k (tension). Calculate the applied load P_x, forces in the other members of the truss, reactions at supports E and F and the horizontal and vertical deflections of joint B.

12. In the three-dimensional truss ABCD shown below, ignore the zero-force members and formulate the stiffness matrix, load vector and write down the boundary conditions
[Given: EA/L = constant = 500 kip/ft].



Nodal Coordinates
A (0, 0, 0), B (34.64, –20, 0), C (60, 0, –30), D (60, 0, 20)

13. Use the Stiffness Method to calculate the rotations at D and E about the z-axis (θ_z) for the grid shown in the figure below (*The problem can be simplified by considering symmetry about the x-axis*) [Given: EI = 40×10^3 k-ft^2, GJ = 30×10^3 k-ft^2].



14. (i) What is meant by Moment Distribution Factor and Carry Over Factor?
    (ii) Explain the difference between the influence lines of statically determinate and indeterminate structures.
    (iii) What is the main feature of the diagonal and off-diagonal elements of stiffness matrix?
    (iv) Why are the stiffness matrices of 3D truss and grid both (6×6)?
    (v) Mention the difference between shape functions [$\phi(x)$ and $\psi(x)$] and boundary conditions for the analysis of axially loaded bars and transversely loaded beams.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B. Sc Engineering (Civil)

Course Title: Structural Analysis and Design V Course Code: CE 415 Credit: 2.00
Time : 2.00 Hours Full Marks:100 (= 20 × 5)

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

1. (a) Compute the value of live load that the beam in Fig.1 can carry, producing 1.5 MPa tensile stress (flexural) at midspan section. Use the 'Second Concept' for the analysis. Given: n=7, Effective prestress=1200 kN **[08]**

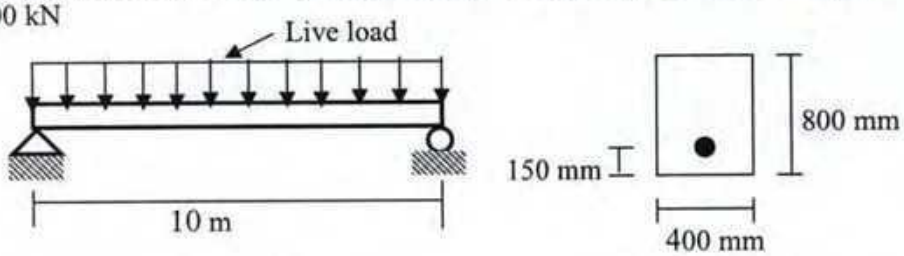
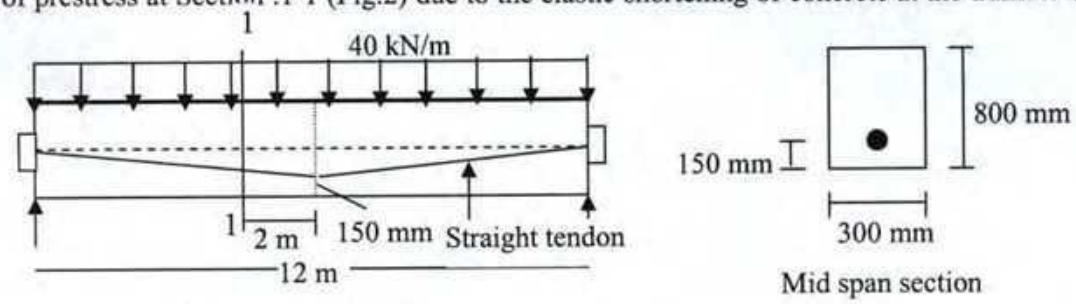


Fig.1 Mid span section

(b) Describe briefly the different sources which cause loss of prestress in a prestressed concrete member. **[05]**

(c) A pretensioned concrete member 12.0 m long is eccentrically prestressed with 900 mm^2 of steel wires which are anchored to the bulkheads with a stress of 1000 MPa. If E_{ci}= 30000 MPa and E_s=2,00,000 MPa, compute the loss of prestress at Section .1-1 (Fig.2) due to the elastic shortening of concrete at the transfer of prestress. **[07]**

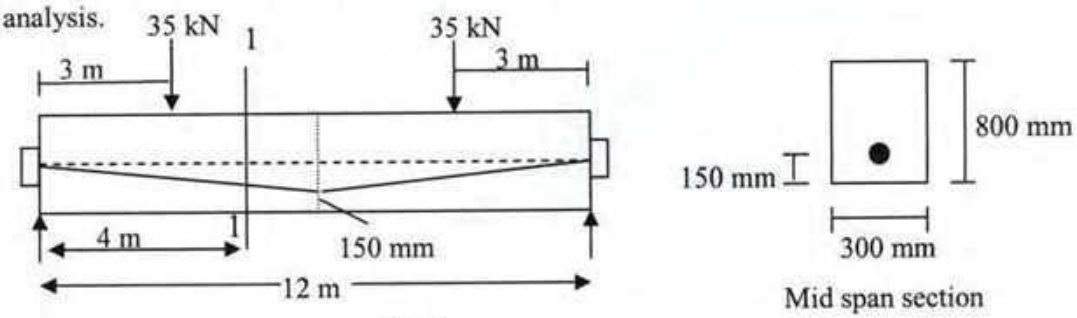


Mid span section

Fig.2

2.(a) A posttensioned bonded concrete beam has a prestress of 1500 kN in the steel immediately after prestressing, which eventually reduces to 1300 kN due to losses. The beam carries two live loads of 35 kN each in addition to its own weight of 5.76 kN/m. Compute the extreme fiber stresses at the section (Sec. 1-1) shown in Fig.3. **[10]**

i) at the initial condition with full prestress and no live load
ii) at the final condition, after the losses have taken place with full live load.
Use "First concept" of analysis.



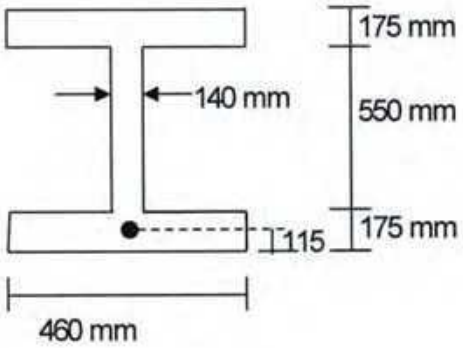
Mid span section

Fig.3

(b) Show the stress distributions in a prestressed concrete beam section for different locations of compressive force (C) according to elastic theory. **[06]**

(c) Describe briefly the prestress transfer bond in pretensioned concrete member. Write the parameters which affect the transfer length for prestressing steel of pretensioned member. **[04]**

3. (a) Calculate the ultimate moment capacity of the PC beam shown in Fig.4. The beam is prestressed with A_{ps}=2450mm^2 with an effective prestress, f_{se}=1100 ksi. The c.g. of steel is 115 mm above the bottom of the beam as shown. Given: f_{pu}=1860 MPa, f_c'=48 MPa **[15]**



$$f_{ps} = f_{pu}[1-0.5\rho_p \frac{f_{pu}}{f_c'}]$$

Fig. 4

(b) Show with neat sketches, the stress distribution for a composite section at the midspan of a simply supported beam whose lower stem is precast and the top slab is cast in place. **[05]**

4. (a) " In the design of PC beam, M_G/M_T ratio plays an important role"-explain. **[04]**

(b)Design a prestressed concrete beam for a simple span of 25m having an overall depth of 1.5 m. The beam is to support a total load of 18 kN/m including self wt. **[16]**

[Given: f_c' = 30 MPa f_{pu}= 1600 MPa
f_c=0.45f_c' f_{ci}=0.65f_c' f_{so} =0.7 f_{pu}]

Design as T beam and assume total loss=20%

5. (a) A rectangular prestress concrete beam is shown in Fig.5. with deflected cable layout. It has to carry a superimposed dead load of 12 kN/m and service live load of 16kN/m in addition to its own weight. Prestressing steel is 1720 MPa Grade strands with total area 1760 mm^2. Calculate the flexural shear and web shear resistance of concrete at a section 4m from left support. Hence, find the vertical U-stirrup requirement of the said section. **[16]**

[Given:
f_c' = 49 MPa f_{se}=1050 MPa
f_{vy}= 275 MPa γ_{con}= 24.1 kN/m^3]

[$V_{ci}=0.05\sqrt{f_c'}\, b_w d + V_d + V_i M_{cr}/M_{max}$
$M_{cr}=I/y_t(0.5\sqrt{f_c'}+f_{pe}-f_d)$
$V_{cw}= 0.29\sqrt{f_c'}\, b_w d +0.3 f_{pc} b_w d + V_p$]

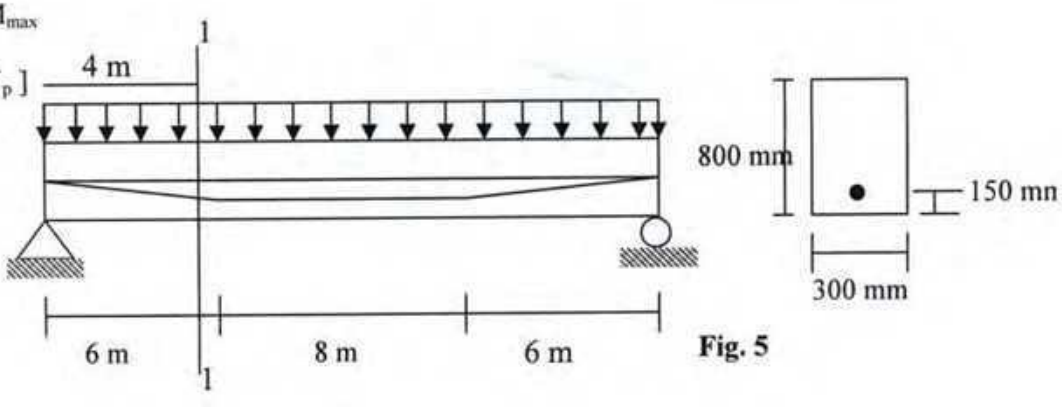


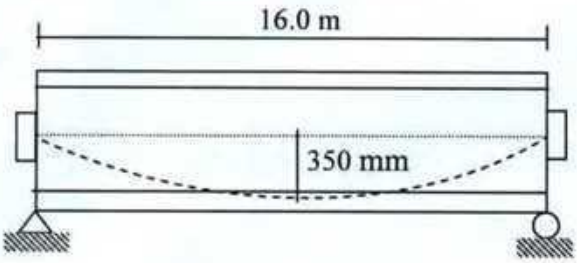
Fig. 5

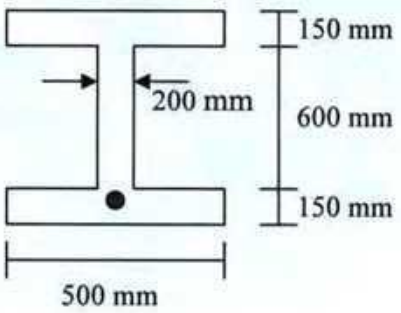
(b) Make 3 important cable layouts for partially prestressed continuous beams. **[04]**

6. (a) Calculate the mid-span deflection of a 16.0 m span I-beam as shown in Fig. 6. **[14]**
   i) Immediately after transfer of prestress
   ii) After 10 years

The beam carries 4 kN/m of service dead load in addition to its own weight. A concentrated live load of 75 kN acts at mid-span.

Given: A_{ps}=1730 mm^2 f_{pi}=1300 MPa
f_{pe}=1120 MPa (after 5 years)
C_u=2.30 γ_{con}=24 kN/m^3
E_{ci}=25100 MPa E_c=27400 MPa





Mid-section

Fig.6

Formula: $\Delta = -\Delta_{pi} + \Delta_0$

$$\Delta = -\Delta_{pi} - \frac{\Delta_{pi} + \Delta_{pe}}{2} C_t + (\Delta_0 + \Delta_d)(1 + C_t) + \Delta_l$$

(b) Describe the parameters (in brief) involved in controlling the layout of a prestressed concrete beam. Show the desirable layouts for simple pretensioned and posttensioned beams. **[06]**

7. (a) What are the advantages and disadvantages of partial prestressing **[05]**

(b) Show with the sketches the uses of non-prestressed reinforcement at the following stages: **[04]**
- Just after transfer of prestress
- At working and ultimate loads

(c) Show with neat sketches the undesirable positions for c.g.s. zone limits in simple beam. **[03]**

(d) Describe the procedure for analyzing the continuous prestressed concrete beam with neat sketches. Show M_1, M_2 , e_1 and e_2 on the figure. **[08]**

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering III Course# CE 431 Credit: 2.00
Time: 2 Hours Full Marks: 100

*There are **Seven** questions Answer any **Five***
(5X20=100)
(Assume reasonable values for missing data)

Q1. **(a)** For the solid waste sample given in the table below estimate (15)

1. Unit energy content
2. Unit energy content (dry basis) and
3. Unit Energy content (Ash free dry basis).
   Assume 5.0% ash content.

Component	Percent by mass	Moisture content %	Energy kJ/kg
Food waste	20	70	69,750
Paper	25	6	753,750
Cardboard	12	5	163,000
Plastic	24	2	326,000
Garden Trimmings	5	60	65,000
Wood	10	20	93,000
Tine cane	4	3	3,500

(b) Write down the biological properties of Municipal Solid Waste. (5)

Q2. **(a)** Name the factors that effects generation rate. (4)
(b) What is transfer station? State the classification of transfer station with respect to method used to load the transport vehicle. (4)
(c) Explain waste allocation with diagram and its categorically solution procedure and express in mathematical equations. (12)

Q3. **(a)** Solid wastes from Dhanmondi area are to be collected using a stationary-container collection system having 4 m^3 containers. Determine the appropriate truck capacity for the following condition: (15)

1. Container size = $4m^3$
2. Container utilization factor = 0.75
3. Average number of container at each location = 2
4. Collection vehicle compaction ratio = 2.5
5. Container unloading time = 0.1 h/container
6. Average drive time between container location = 0.1 h
7. One way haul distance = 30 km
8. Speed limit = 56 km/hr.
9. Time from garage to first container location = 0.33 h

10. Time for last container location to garage = 0.25 h
11. Number of trip to disposal site per day = 2
12. Length of work day = 8 h

Determine number of container that can be emptied per trip and the capacity of the collection truck. Assume any necessary data that is not provided.

Speed limit (km/h)	a h/trip	b h/trip
88	0.016	0.011
72	0.022	0.014
56	0.034	0.018
40	0.050	0.025

Table: Typical value for haul constant coefficients a and b

(b) Define the following terms both for HCS and SCS (5)
1. Pickup time
2. Haul time
3. At-site time

Q4. **(a)** What is hazardous waste? What are the problems that have been related to the treatment and disposal of hazardous waste in developing country? (5)

(b) Represent the advantage, disadvantage and limitation of physical and chemical treatment process in a tabular form. (15)

Q5. **(a)** Draw a flow chart for the determination of hazardous waste. (5)

(a) Draw a cross sectional diagram of a double-lined Landfill for hazardous waste. (5)

(c) Write the design consideration of a hazardous waste landfill. (10)

Q6. **(a)** What is Incineration? Write the standards of incineration. (7)

(b) Draw a flow chart diagram for hospital waste management. (8)

(c) What are the common hazardous wastes that present in the hospital waste? (5)

Q7. **(a)** Estimate the amount of gas (Methane, CO_2, NH_3) produce in a sanitary landfill per 200lb waste having 45% volatile organic waste on dry basis, the percent composition of the volatile organic materials are C=40%, O=55%, N=1%, H=4%. The density of Methane, CO_2, and NH3 are 0.0448, 0.1235 and 0.0482 respectively at atmospheric pressure. (8)

(b) What are the generalized phases in the generation of landfill gas? Give brief explanation of each of the phase. (12)

Formula:

1. $H = [(t_1 + t_2) + N_d(T_{scs})]/(1 - W)$

2. $T_{scs} = P_{scs} + s + a + bx$

3. $P_{scs} = C_t uc + (n_p - 1)dbc$

4. $C_t = \frac{vr}{cf}$

6. $N_d = [(1 - W)H - (t_1 + t_2)]/(P_{hcs} + s + a + bx)$

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

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall- 2007
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering V Course Code: CE 435 Credit: 2.00
Full Marks: 100 Time: 2 hours

Answer any Six questions. Answer any Four. The figure in the margin indicates full marks.

1. Define EIA. Discuss briefly four EIA methodologies with their merits and demerits. 25

2. (a) Values of " Environmental Qualities (EQ)" of a cement factory are given below. Determine Environmental Importance (EI) for 'human health' 15

Parameters	Values of EQ		EI
	With project	Without project	
1. Land value	5	2	100
2. Air quality	2	8	250
3. Agriculture	3	6	150
4. Navigation	5	6	100
5. Human Health	3	8	?
6. Socio-economic	10	2	250

Also determine whether the project is environmentally sustainable or not.

(b) Discuss briefly the potential impacts of small irrigation schemes. 10

3. Discuss briefly the potential Environmental Impacts (both positive and negative) of Water Resources Development Projects for the following parameters: 25
(i) Agriculture
(ii) Fisheries
(iii) Water quality
(iv) Social benefits

4. (a) RAJUK is planning to develop 2000 acres land for urban growth center named as uttara 3rd phase. Discuss briefly the Environmental issues for that urban growth center. 15

(b) State different Environmental effects commonly associated with the location of industries. 10

5. (a) What are the guiding strategies to achieve the goal of sustainable development? 10

(b) Discuss briefly the Ecosystem of the Environment. 8

(c) Write short note on "population carrying capacity". 7

6. (a) What are the objective of "Environmental monitoring"? 5

(b) What are the potential impacts and possible mitigation measures of 10
(i) observation to navigation
(ii) Destruction of fish by uncontrolled use of pesticides.

(c) Define environmental quality standards. Discuss briefly Bangladesh 10
Environmental Standards for noise and air pollution.

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall- 2007
Program: B.Sc. Engineering (Civil)

Course Title: Chemistry | Course Code: CHEM 111 | Credit: 3.00
Full Marks: 50 | Time: 3 hours

Answer any Five questions. The figure in the margin indicates full marks.

1.	(a)	Define 'macromolecules'. Why are they called so?	2
	(b)	Distinguish between 'thermoplastic' and ' thermosetting' polymers.	4
	(c)	Give the reactions involved in the synthesis of the following macromolecules: (i) Nylon 66 and, (ii) Epoxy resin	4
2.	(a)	State '*order*' and '*half-life*' of a reaction.	2
	(b)	Derive mathematically integrated rate equation for a 1^{st} order reaction.	4
	(c)	30% of a 1^{st} order reaction is completed in 60 minutes. Find i) the value of 'k' and, (ii) time to complete 60% reaction.	4
3.	(a)	Name the major and minor chemical components of atmosphere.	2
	(b)	What is 'acid rain'? Show the chemical reactions involved in the formation of H_2SO_4 acid droplets.	5
	(c)	How is O_3 depleted from atmosphere? Discuss with chemical reactions.	3
4.	(a)	State the '*law of chemical equilibrium*'.	1
	(b)	Find the relation between the equilibrium constants K_p, K_c and K_x for each of the following gaseous systems: i) $N_2 + 3H_2 \rightleftarrows 2NH_3$ ii) $PCl_5 \rightleftarrows PCl_3 + Cl_2$ iii) $N_2O_4 \rightleftarrows 2NO_2$	6
	(c)	At 25^0C and 1 atm pressure, PCl_5 dissociates to 80%. Calculate the equilibrium constant, K_p.	3
5.	(a)	What is meant by 'hard water'?	2
	(b)	Discuss EDTA titrimetric method for the determination of water hardness.	4
	(c)	What are the dissolved and suspended impurities that make water polluted?	4
6.	(a)	Define 'lyophobic' colloid.	2
	(b)	Describe the preparation of Ag colloids by a Bredig's Arc Method.	5
	(c)	Discuss the 'Tyndal effect' exhibited by the Ag colloids.	3
7.	(a)	What is 'dry corrosion'?	2
	(b)	Discuss the 'blistering' and 'decarburization' of Fe metal by dry corrosion.	5
	(c)	How a metal under water become corroded? Show the chemical reactions.	3

The University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2007
Program: B. Sc Engineering (Civil)

Course Title: Principles of Economics Course Code: ECN 201 Credit: 2.00
Time : 2.00 Hours Full Marks:60

There are Eight (8) Questions. Answer any Six (6). Marks allotted are indicated in the margin.

Q.1."In Monopolistic Competition both profit and loss can occur in short run"-Explain. **[10]**

Q.2.a) Discuss Distribution of Tax Burden. **[07]**

b) Suppose the CPI in the year 2006 was 90. A hypothetical budget survey shows that consumers spend 50% of their income on food 30% on shelter and 20% on education. Now in the year 2007 prices of food rise by 10% and prices of education fall by 5%. Calculate CPI and Rate of Inflation for the year 2007. **[03]**

Q.3.a) Discuss Minimum Average Cost (AC). **[05]**

b) Discuss Long Run Envelope Curve. **[05]**

Q.4. Discuss Demand Pull and Cost Push Inflation. **[10]**

Q.5.a) How does flexible wage rate create voluntary unemployment. **[07]**

b) Given AR= 30Q2+15Q+12/Q, find Marginal Revenue **[03]**

Q.6.Discuss Lewis model of Development. **[10]**

Q.7. a) Discuss equilibrium output determination in a closed economy model. **[07]**

b) Given C =1200+0.8Yd when Yd = Y-T and T = 100. Find MPC and MPS. **[03]**

Q.8.a) Critically discuss the Law of Diminishing Marginal Product. **[07]**

b) A monopolist sells two products x and y for the demand functions are **[03]**
$x = 25 - 0.5Px$ and $y = 30 - Py$.
The combined cost function is $C = x^2+2xy+y^2+20$.
Find-a) Profit maximizing level of output for x and y.
b) Profit maximizing level of prices for x and y (Px and Py)
c) Maximum profit.