L-3/T-2/ARCH **Date : 08/12/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Arch. Examinations 2012-2013

Sub : **CE 367(CE 323)** (Structure IV : Steel and Timber Structures)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

Use tables and charts given in annexure if required.

1. (a) Compute the axial load carrying capacity of the column shown in Fig. 1. The column is fixed at both ends and braced at mid-height against bucking about the weak axis. Use A36 steel properties. Given that, **(17)**

$$F_a = \frac{F_y\left[1-\frac{1}{2}\left(\frac{KL/r}{C_c}\right)^2\right]}{\frac{5}{3}+\frac{3}{8}\left(\frac{KL/r}{C_c}\right)-\frac{1}{8}\left(\frac{KL/r}{C_c}\right)^3} \quad \text{if } \frac{KL}{r} \le C_c$$

$$F_a = \frac{12\pi^2 E}{23\left(\frac{KL}{r}\right)^2} = \frac{149000}{\left(\frac{KL}{r}\right)^2} \quad \text{if } \frac{KL}{r} \ge C_c$$

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

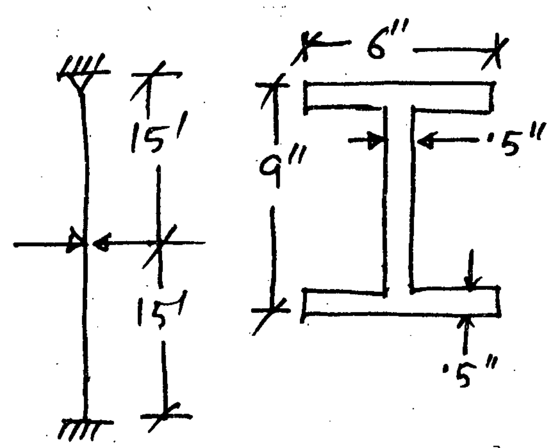

Fig. 1

(b) Prove that for a rectangular beam section, maximum shear stress is $\frac{3V}{2A}$. **(6⅓)**

2. (a) Write a short note on different properties of wood parallel and perpendicular to grain. **(3)**

(b) Write short notes on - **(16)**

(i) Slenderness ratio, R_B

(ii) Bearing Area Factor, C_b

(iii) Cellular makeup of woods

(iv) Effect of moisture content and shrinkage on properties of wood

(c) Why is it important to make a beam laterally stable? How can you handle this issue if a beam is laterally unstable? **(4⅓)**

3. Two 3" × 10" Visually Graded No.1 Alaska Spruce is used together as a single beam to carry dead load only. The beam is used in wet conditions and normal temperature. Also the beam is laterally supported along its length and at each end. Total load on the beam is 700 lb/ft and the span of the beam is 12 feet.

Use Annexure 1, 2 and 3 for required data. Assume a reasonable value for any missing data.

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Contd P/2

CE 367

Contd ... Q. No. 3

(a) Assuming the beam simply supported at both ends, locate the section where maximum bending stress develops and determine the magnitude of maximum bending stress on the section. **(5)**

(b) Determine the allowable bending stress, F'_b for the beam. **(6)**

(c) Based on the answers from (a) and (b), determine if the beam is adequate to support the load. If not, determine the number of additional 3" × 10" lumbers that are needed to reduce bending stress below allowable stress. **(7)**

(d) Locate the section where the maximum value for shear force is observed for this beam. Also compute the maximum shear stress to check the adequacy of the section (after modification in (c), if any) for shear. **(5⅓)**

4. (a) For the beam in Question 3 (initial section, two 3" × 10" Visually graded No. 1 Alaska Spruce), calculate the maximum deflection due to dead load. Also state if this deflection is within allowable deflection limit for dead load.
Use Annexure 1, 2 and 3 for required data. Assume a reasonable value for any missing data. **(4)**

(b) The beam in 8(a) is to be supported by columns at the ends. Determine the required bearing area at the supports.
Use Annexure 1, 2 and 3 for required data. Assume a reasonable value for any missing data. **(3)**

(c) Select the lightest W shape from the Table provided in Annexure 4 to support a dead load of 120 kips and a live load of 200 kips. The column is 32 feet long. Assume that it is pin supported at the top and bottom in both directions that an additional support is provided at mid-height to prevent buckling against the y-axis. Use AISC/ASD formulae and AISC Allowable axial load table. **(16⅓)**

SECTION – B

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

5. Design the following members of an industrial roof truss (shown in Fig. 2)from the load table given below:

Member	Member Force (kip)		
	Dead load (kip)	Wind (left-to-right) (kip)	Wind (right-to-left) (kip)
U_2U_3	-10	15	20
U_2L_3	-5	19	-4
U_1L_1	1	0	0

Assume, K = 0.6, F_y = 36 ksi, E = 29000 ksi (Annexure 1 is attached for section properties) **(23⅓)**

Contd P/3

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Contd... Q. No. 5

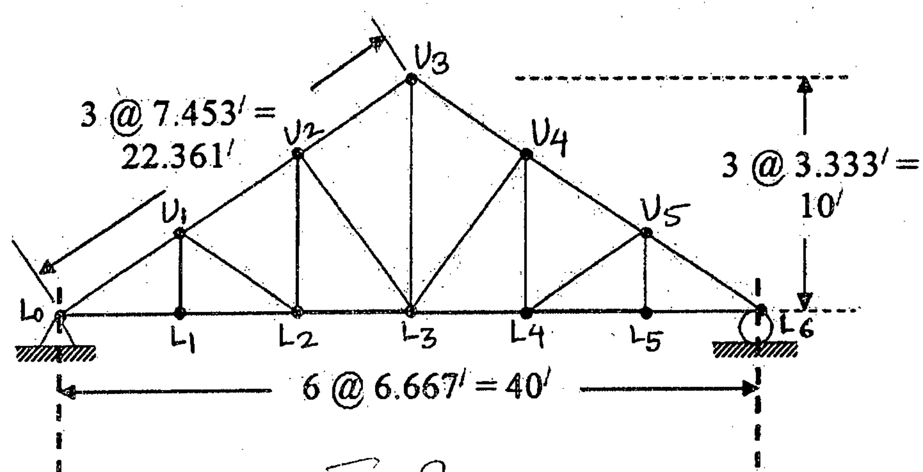

Fig. 2

6. (a) Draw a simple roof truss and show different components on it.

   (b) Suppose, members U_2U_3 and U_2L_3 mentioned in Question 5 (refer to Fig. 2) are designed to be L $3\frac{1}{2} \times 3 \times \frac{3}{8}$ and L $3 \times 2\frac{1}{2} \times \frac{5}{16}$ respectively. At node U_2 both of them are connected to a gusset plate of thickness $\frac{1}{2}$ inch. Design fillet welds for this connection. Given, $F_y = 36$ ksi. Use Annexure 1, 3. **(23⅓)**

7. Following data are given for the question below: **(23⅓)**

   CGI roofing = 2.0 psf

   Self-weight of purlins = 1.5 psf

   Spacing between adjacent trusses = 25 ft

   Design Wind Pressure:

   Windward Side = – 5 psf

   Leeward side = – 20 psf

   Trial section for Purlin (A36 steel):

   (1) C 5 × 6.7 (Sxx = 3 in^3, Syy = 0.378 in^3)

   (2) C 5 × 9 (Sxx = 3.56 in^3, Syy = 0.45 in^3)

   (3) C 7 × 9.8 (Sxx = 6.08 in^3, Syy = 0.625 in^3)

   Sagrod is provided at half the distance in between trusses.

   Consider X-axis in the plane of roofing and Y-axis in the perpendicular direction of the plane of roofing. Equation for moment about X-axis is $wL^2/8$ and moment about Y-axis is $wL^2/32$.

   Check the adequacy of the trial purlin sections considering both dead load and wind load for the truss shown in Fig. 2. Comment on, whether the section (1), (2), (3) are adequate or not.

Contd P/4

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8. Calculate the joint loads for dead load and wind load (show the loading diagram with loads at the joint) for the 30 ft span interior truss of an industrial building (Fig. 2). Spacing between two adjacent trusses (bay) is 25 ft. Show the loads with neat sketches. **(23⅓)**

Given:

Loads:

(a) CGI Sheet Roofing = 2.0 psf

(b) Purlins = 1.5 psf

(c) Sagrod, Bracings = 1 psf

(d) Self-weight of Truss = 50 lb/ft of horizontal span

Design Wind Speed = 210 km/h

Wall Height = 12 ft

$C_c = 47.2 \times 10^{-6}$

$q_z = C_c\, C_I C_z\, V_b^2$

$p_z = C_G C_{pe} q_z$

$1\text{kN/m}^2 = 20.88$ psf

Other charts are enclosed with the question (Annexure 2, 4, 5).

=5=

ANNEXURE-1

Design Values for Visually Graded Dimension Lumber (2"-4" thick) Except Southern Pine* **								
Species and commercial grade	Size classification	Bending Fb	Tension parallel to grain Ft	Shear parallel to grain Fv	Compression perpendicular to grain Fc⊥	Compression parallel to grain Fc	Modulus of Elasticity E	Minimum Modulus of Elasticity Emin
Alaska Cedar								
Select Structural		1150	625	165	525	1000	1400000	510000
No. 1		975	525	165	525	900	1300000	470000
No. 2		800	425	165	525	750	1200000	440000
No. 3	2" & wider	450	250	165	525	425	1100000	400000
Stud		625	350	165	525	475	1100000	400000
Construction	2" & wider	900	500	165	525	950	1200000	440000
Standard		500	275	165	525	775	1100000	400000
Utility	2"- 4" wide	250	125	165	525	500	1000000	370000
Alaska Hemlock								
Select Structural		1300	825	185	440	1200	1700000	620000
No. 1		900	550	185	440	1100	1600000	580000
No. 2		825	475	165	440	1050	1500000	550000
No. 3	2" & wider	475	275	185	440	600	1400000	510000
Stud		650	375	165	440	650	1400000	510000
Construction	2" & wider	950	550	185	440	1250	1400000	510000
Standard		525	300	165	440	1050	1300000	470000
Utility	2"- 4" wide	250	150	165	440	700	1200000	440000
Alaska Spruce								
Select Structural		1400	900	160	330	1200	1600000	580000
No. 1		950	600	160	330	1100	1500000	550000
No. 2		875	500	160	330	1050	1400000	510000
No. 3	2" & wider	500	300	160	330	600	1300000	470000
Stud		675	400	160	330	675	1300000	470000
Construction	2" & wider	1000	575	160	330	1250	1300000	470000
Standard		550	325	160	330	1050	1200000	440000
Utility	2"- 4" wide	275	150	160	330	700	1100000	400000
Alaska Yellow Cedar								
Select Structural		1350	800	225	510	1200	1500000	550000
No. 1		900	525	225	510	1050	1400000	510000
No. 2		800	450	225	510	1000	1300000	470000
No. 3	2" & wider	475	250	225	510	575	1200000	440000
Stud		625	350	225	510	625	1200000	440000
Construction	2" & wider	925	500	225	510	1250	1300000	470000
Standard		500	275	225	510	1050	1100000	400000
Utility	2"- 4" wide	250	125	225	510	675	1100000	400000

Frequently Used Load Durations Factors C_D[1]		
Load Duration	**C_D**	**Typical Design Loads**
Permanent (>10 yrs)	0.9	Dead Load
Ten Years (Normal)	1.0	Occupancy Live Load
Two Months	1.15	Snow Load
Seven Days	1.25	Construction Load (Roof Included)
Ten Minutes	1.6	Wind/Earthquake Load
Impact[2]	2.0	Impact Load

ANNEXURE-2

Moisture Content Factors C_M [a,b,e]								
Strength Property	Fb	Ft	Fc	Fc⊥	Fv	E	Frt	Fg
Sawn Lumber, Visual or Machine Graded Wet conditions of use MC > 19% Dimension lumber (including Southern Pine)	0.85[a]	1.00	0.80[b]	0.67	0.97	0.90	–	–d
5 in. X 5 in. and larger	1.00	1.00	0.91	0.67	1.00	1.00	–	–d
Decking Wet conditions if use all Species except Southern Pine[c]	0.85	--	--	0.67	--	0.90	–	–

Notes:
a) When $(F_b)(C_F)$ for dimension lumber of all species ≤ 1150 psi, $C_M = 1.0$.
b) When $(F_c)(C_F)$ for dimension lumber of all species except Southern Pine ≤ 750 psi, $C_M = 1.0$; when F_c for visually graded Southern Pine ≤ 750 psi, $C_M = 1.0$.
c) For Southern Pine, use Reference design values for wet service conditions

SIZE FACTORS, C_F- for Sawn Lumber not including Southern Pine					
		F_b		F_t	F_c
Grades	Width/Depth	Thickness			
		2" & 3"	4"		
Select Structural, No.1 & Btr. No. 1, No. 2, No. 3	2",3"&4"	1.5	1.5	1.5	1.15
	5"	1.4	1.4	1.4	1.1
	6"	1.3	1.3	1.3	1.1
	8"	1.2	1.3	1.2	1.05
	10"	1.1	1.2	1.1	1.0
	12"	1.0	1.1	1.0	1.0
	14" & Wider	0.9	1.0	0.9	0.9
Stud	2", 3" & 4"	1.1	1.1	1.1	1.05
	5" & 6"	1.0	1.0	1.0	1.0
Construction & Standard	2", 3, & 4"	1.0	1.0	1.0	1.0
Utility	4"	1.0	1.0	1.0	1.0
	2" & 3"	0.4	--	0.4	0.6

Flat Use Factor, C_{fu} for Visually and Machine Graded Sawn Lumber (including Southern Pine)		
Width (depth)	Thickness (breadth)	
	2" & 3"	4"
2" & 3"	1.0	--
4"	1.1	1.0
5"	1.1	1.05
6"	1.15	1.05
8"	1.15	1.05
10" & Wider	1.2	1.1

ANNEXURE-3

TEMPERATURE FACTORS, C_t				
Design Values	In Service Moisture Conditions	C_t T≤100°F	C_t 100°F<T≤125°F	C_t 125°F<T≤150°F
F_t, E	Wet or Dry	1.0	0.9	0.9
F_b, F_v, F_c and $F_{c\perp}$	Dry	1.0	0.8	0.7
F_b, F_v, F_c and $F_{c\perp}$	Wet	1.0	0.7	0.5

BEARING AREA FACTOR, C_b							
Length of Bearing, in.	½	4	1 ½	2	3	4	6 or more
C_b	1.75	1.38	1.25	1.19	1.13	1.10	1.00

Recommended Deflection Limitations

Use classification	Applied load only	Applied load + dead load
Roof beams		
Industrial	l/180	l/120
Commercial and institutional		
Without plaster ceiling	l/240	l/180
With plaster ceiling	l/360	l/240
Floor beams		
Ordinary usage*	l/360	l/240
Highway bridge stringers	l/200 to l/300	
Railway bridge stringers	l/300 to l/400	

* The ordinary usage classification is for floors intended for construction in which walking comfort and minimized plaster cracking are the main considerations. These recommended deflection limits may not eliminate all objections to vibrations such as in long spans approaching the maximum limits or for some office and institutional applications where increased floor stiffness is desired. For these usages the deflection limitations in the following table have been found to provide additional stiffness.

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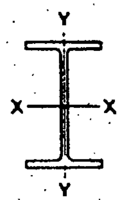
ANNEXURE- 4

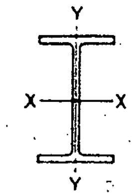


F_y = 36 ksi

F_y = 50 ksi

COLUMNS
W shapes
Allowable axial loads in kips

Designation	W10									
Wt./ft	112		100		88		77		68	
F_y	36	50	36	50	36	50	36	50	36	50
Effective length in ft KL with respect to least radius of gyration r_y: 0	711	987	635	882	559	777	488	678	432	600
6	663	906	592	808	521	712	454	620	402	548
7	653	888	583	792	513	697	447	607	395	537
8	642	869	573	775	504	682	439	593	388	525
9	631	848	562	756	495	665	431	579	381	512
10	619	827	551	737	485	648	422	564	373	498
11	606	805	540	717	475	630	413	548	365	484
12	593	782	528	696	464	611	404	531	357	469
13	579	757	516	674	453	591	394	513	348	454
14	565	732	503	651	442	571	384	495	339	437
15	550	706	489	627	430	550	373	476	330	421
16	535	679	476	602	417	528	362	457	320	403
17	519	651	461	577	405	505	351	437	310	385
18	503	622	446	550	392	481	339	416	299	366
19	486	591	431	523	378	457	327	394	289	347
20	469	560	416	494	364	432	315	371	278	327
22	433	495	383	435	335	379	289	324	255	285
24	395	425	348	372	304	323	261	275	230	242
26	355	362	312	317	271	275	232	234	204	206
28	313	313	273	273	237	237	202	202	177	177
30	272	272	238	238	206	206	176	176	155	155
32	239	239	209	209	181	181	155	155	136	136
34	212	212	185	185	161	161	137	137	120	120
36	189	189	165	165	143	143	122	122	107	107
38	170	170	148	148	129	129	110	110	96	96
40	153	153	134	134	116	116	99	99	87	87
Properties										
U	2.45	2.45	2.46	2.46	2.49	2.49	2.51	2.51	2.52	2.52
P_{wo} (kips)	255	354	214	298	177	246	143	199	116	162
P_{wi} (kips/in.)	27	38	24	34	22	30	19	27	17	24
P_{wb} (kips)	1388	1636	1014	1196	714	842	480	566	335	395
P_{fb} (kips)	352	488	282	392	221	306	170	237	133	185
L_c (ft)	11.0	9.3	10.9	9.3	10.8	9.2	10.8	9.1	10.7	9.1
L_u (ft)	53.2	38.3	48.2	34.7	43.3	31.2	38.6	27.8	34.8	25.1
A (in.^{2})	32.9		29.4		25.9		22.6		20.0	
I_x (in.^{4})	716		623		534		455		394	
I_y (in.^{4})	236		207		179		154		134	
r_y (in.)	2.68		2.65		2.63		2.60		2.59	
Ratio r_x/r_y	1.74		1.74		1.73		1.73		1.71	
B_x Bending factors	0.261		0.263		0.263		0.263		0.264	
B_y Bending factors	0.726		0.735		0.744		0.751		0.758	
$a_x/10^6$	106.5		92.7		79.5		67.9		58.7	
$a_y/10^6$	35.2		30.8		26.7		22.8		20.0	
$F'_{ex}(K_xL_x)^2/10^2$ (kips)	225		219		214		209		204	
$F'_{ey}(K_yL_y)^2/10^2$ (kips)	74.5		72.8		71.7		70.1		69.6	



F_y = 36 ksi

F_y = 50 ksi

COLUMNS
W shapes
Allowable axial loads in kips

Designation	W12											
Wt./ft	106		96		87		79		72		65	
F_y	36	50	36	50	36	50	36	50	36	50	36	50†
Effective length in ft KL with respect to least radius of gyration r_y: 0	674	936	609	846	553	768	501	696	456	633	413	573
6	637	872	575	788	522	715	473	647	430	589	389	533
7	629	858	568	775	515	703	467	637	424	579	384	524
8	620	844	560	762	508	691	460	626	418	569	378	514
9	611	828	552	748	501	678	453	614	412	558	373	504
10	602	812	544	733	493	665	446	601	406	547	367	494
11	593	795	535	718	485	650	439	588	399	535	361	483
12	583	777	526	701	477	636	431	575	392	522	354	472
13	572	759	516	685	468	620	423	561	385	509	348	460
14	561	740	506	667	459	604	415	546	377	496	341	448
15	550	720	496	649	450	588	407	531	369	482	334	435
16	539	699	486	630	440	570	398	515	361	468	326	422
17	527	678	475	611	430	553	389	499	353	453	319	408
18	514	656	464	591	420	534	379	482	344	438	311	394
19	502	634	452	570	409	515	370	465	336	422	303	380
20	489	611	440	549	398	496	360	447	326	406	294	365
22	462	562	416	505	376	455	339	410	308	372	277	334
24	433	511	390	458	352	412	317	371	288	336	259	301
26	404	457	362	408	327	367	294	329	267	297	240	266
28	372	399	334	356	301	319	270	285	245	258	220	230
30	340	348	304	310	273	278	245	249	222	225	199	201
32	305	306	272	273	244	244	219	219	197	197	176	176
34	271	271	242	242	216	216	194	194	175	175	156	156
36	241	241	215	215	193	193	173	173	156	156	139	139
38	217	217	193	193	173	173	155	155	140	140	125	125
40	196	196	175	175	156	156	140	140	126	126	113	113
Properties												
U	2.59	2.59	2.60	2.60	2.62	2.62	2.63	2.63	2.65	2.65	2.66	2.42
P_{wo} (kips)	185	257	161	223	139	193	122	169	106	148	92	128
P_{wi} (kips/in.)	22	31	20	28	19	26	17	24	15	22	14	20
P_{wb} (kips)	588	693	431	508	354	417	269	317	206	243	154	181
P_{fb} (kips)	221	306	182	253	148	205	122	169	101	140	82	114
L_c (ft)	12.9	10.9	12.8	10.9	12.8	10.9	12.8	10.8	12.7	10.8	12.7	10.7
L_u (ft)	43.3	31.2	39.9	28.7	36.2	26.0	33.3	24.0	30.5	21.9	27.7	20.0
A (in.^{2})	31.2		28.2		25.6		23.2		21.1		19.1	
I_x (in.^{4})	933		833		740		662		597		533	
I_y (in.^{4})	301		270		241		216		195		174	
r_y (in.)	3.11		3.09		3.07		3.05		3.04		3.02	
Ratio r_x/r_y	1.76		1.76		1.75		1.75		1.75		1.75	
B_x Bending factors	0.215		0.215		0.217		0.217		0.217		0.217	
B_y Bending factors	0.633		0.635		0.645		0.648		0.651		0.656	
$a_x/10^6$	139.1		124.3		110.4		98.6		88.6		79.3	
$a_y/10^6$	45.0		40.1		36.0		32.2		29.1		26.0	
$F'_{ex}(K_xL_x)^2/10^2$ (kips)	310		307		300		296		292		289	
$F'_{ey}(K_yL_y)^2/10^2$ (kips)	100		99.0		97.7		96.5		95.8		94.6	

†Flange is noncompact; see discussion preceding column load tables.

ANNEEXURE-1

Section	Area (in^2)	Ix (in^4)	Sx (in^3)	rx (in)	Iy (in^4)	Sy (in^3)	ry (in)	Iz (in^4)	rz (in)
L4X4X3/8	2.86	4.32	1.5	1.23	4.32	1.5	1.23	1.73	0.779
L4X4X7/16	3.3	4.93	1.73	1.22	4.93	1.73	1.22	1.99	0.777
L4X4X1/2	3.75	5.62	1.96	1.21	5.62	1.96	1.21	2.25	0.776
L4X4X3/4	5.44	7.62	2.79	1.18	7.62	2.79	1.18	3.25	0.774
L4X4X5/8	4.61	6.62	2.38	1.2	6.62	2.38	1.2	2.76	0.774
L4X3-1/2X3/8	2.68	4.15	1.48	1.25	2.96	1.16	1.05	1.39	0.719
L4X3-1/2X1/2	3.5	5.3	1.92	1.23	3.76	1.5	1.04	1.79	0.716
L3-1/2X3-1/2X1/4	1.7	2	0.787	1.09	2	0.787	1.09	0.802	0.688
L3-1/2X3-1/2X5/16	2.1	2.44	0.969	1.08	2.44	0.969	1.08	0.984	0.685
L3-1/2X3-1/2X3/8	2.5	2.86	1.15	1.07	2.86	1.15	1.07	1.17	0.683
L3-1/2X3X1/4	1.58	1.92	0.773	1.1	1.3	0.585	0.908	0.622	0.628
L3-1/2X3X5/16	1.95	2.33	0.951	1.09	1.58	0.718	0.9	0.758	0.624
L3-1/2X3X3/8	2.32	2.73	1.12	1.09	1.84	0.847	0.892	0.894	0.622
L3-1/2X3X7/16	2.67	3.1	1.29	1.08	2.09	0.971	0.885	1.02	0.62
L3X3X1/4	1.44	1.23	0.569	0.926	1.23	0.569	0.926	0.49	0.585
L3X3X5/16	1.78	1.5	0.699	0.918	1.5	0.699	0.918	0.606	0.583
L3X3X3/8	2.11	1.75	0.825	0.91	1.75	0.825	0.91	0.716	0.581
L3X3X7/16	2.43	1.98	0.946	0.903	1.98	0.946	0.903	0.817	0.58
L3-1/2X2-1/2X1/4	1.45	1.81	0.753	1.12	0.775	0.41	0.731	0.426	0.541
L3-1/2X2-1/2X5/16	1.79	2.2	0.925	1.11	0.937	0.501	0.723	0.518	0.538
L3-1/2X2-1/2X3/8	2.12	2.56	1.09	1.1	1.09	0.589	0.716	0.609	0.535
L3X2-1/2X5/16	1.63	1.41	0.681	0.932	0.888	0.487	0.739	0.435	0.518
L3X2-1/2X3/8	1.93	1.65	0.803	0.924	1.03	0.573	0.731	0.514	0.517
L3X2-1/2X1/2	2.5	2.07	1.03	0.91	1.29	0.736	0.718	0.665	0.516
L3X2-1/2X7/16	2.22	1.87	0.921	0.917	1.17	0.656	0.724	0.594	0.516
L2-1/2X2-1/2X1/4	1.19	0.692	0.387	0.764	0.692	0.387	0.764	0.276	0.482
L2-1/2X2-1/2X3/16	0.901	0.535	0.295	0.771	0.535	0.295	0.771	0.209	0.482
L2-1/2X2X3/16	0.818	0.511	0.293	0.79	0.292	0.195	0.597	0.148	0.426
L2-1/2X2X1/4	1.07	0.656	0.381	0.782	0.372	0.253	0.589	0.192	0.423
L2-1/2X2X5/16	1.32	0.79	0.465	0.774	0.446	0.309	0.581	0.233	0.42
L2X2X1/8	0.491	0.189	0.129	0.62	0.189	0.129	0.62	0.0756	0.391
L2X2X3/16	0.722	0.271	0.188	0.612	0.271	0.188	0.612	0.109	0.389
L2X2X1/4	0.944	0.346	0.244	0.605	0.346	0.244	0.605	0.142	0.387
L2X2X3/8	1.37	0.476	0.348	0.591	0.476	0.348	0.591	0.203	0.386
L2X2X5/16	1.16	0.414	0.298	0.598	0.414	0.298	0.598	0.172	0.386
L2-1/2X1-1/2X3/16	0.724	0.464	0.28	0.801	0.126	0.11	0.418	0.0754	0.324
L2-1/2X1-1/2X1/4	0.947	0.594	0.364	0.792	0.16	0.142	0.411	0.0977	0.321

ANNEXURE-2

External Pressure Coefficients, C_{pe} for Roof †

Wind Direction	h/L	Windward Side θ (degrees): 0	10-15	20	30	40	50	>60	Leeward Side
Normal to ridge	≤0.3	-0.7	0.2* / -0.9*	0.2	0.3	0.4	0.5	0.01 θ	-0.7 for all values of h/L and θ
	0.5	-0.7	-0.9	-0.75	-0.2	0.3	0.5	0.01 θ	
	1.0	-0.7	-0.9	-0.75	-0.2	0.3	0.5	0.01 θ	
	≥1.5	-0.7	-0.9	-0.9	-0.9	-0.35	0.2	0.01 θ	
Parallel to ridge	h/B or h/L ≤ 2.5				-0.7				-0.7
	h/B or h/L > 2.5				-0.8				-0.8

† Coefficients are to be used with $p_h = C_G C_{pe} q_h$, see Sec 2.4.6.6(a).
* Both values of C_{pe} shall be used for load calculations.

Note: (1) These coefficients shall be used with Method 1, Sec 2.4.6.4 (a).
(2) Refer to Table 6.2.13 for arched roofs.
(3) For flexible buildings and structures, use appropriate $\bar{G}$ as determined by Sec 2.4.6.6 (c).
(4) Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
(5) Linear interpolation may be made for values of θ, h/L, and L/B ratios other than listed.

ANNEXURE-3

Thickness of the parts to be welded	Minimum fillet weld size	Maximum fillet weld size
1/4 inch or less	1/8 inch	Thickness of parts
Over 1/4" to 1/2"	3/16 inch	1/16" less than thickness of parts
Over 1/2" to 3/4"	1/4 inch	
Over 3/4"	5/16 inch	

ANNEXURE-4

Combined Height and Exposure Coefficient, C_z

Height above ground level, z (metres)	Coefficient, C_z (1)		
	Exposure A	Exposure B	Exposure C
0-4.5	0.368	0.801	1.196
6.0	0.415	0.866	1.263
9.0	0.497	0.972	1.370
12.0	0.565	1.055	1.451
15.0	0.624	1.125	1.517
18.0	0.677	1.185	1.573
21.0	0.725	1.238	1.623
24.0	0.769	1.286	1.667
27.0	0.810	1.330	1.706
30.0	0.849	1.371	1.743
35.0	0.909	1.433	1.797
40.0	0.965	1.488	1.846
45.0	1.017	1.539	1.890
50.0	1.065	1.586	1.930
60.0	1.155	1.671	2.002
70.0	1.237	1.746	2.065
80.0	1.313	1.814	2.120
90.0	1.383	1.876	2.171
100.0	1.450	1.934	2.217
110.0	1.513	1.987	2.260
120.0	1.572	2.037	2.299
130.0	1.629	2.084	2.337
140.0	1.684	2.129	2.371
150.0	1.736	2.171	2.404
160.0	1.787	2.212	2.436
170.0	1.835	2.250	2.465
180.0	1.883	2.287	2.494
190.0	1.928	2.323	2.521
200.0	1.973	2.357	2.547
220.0	2.058	2.422	2.596
240.0	2.139	2.483	2.641
260.0	2.217	2.541	2.684
280.0	2.910	2.595	2.724
300.0	2.362	2.647	2.762

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

ANNEXURE- 5

Gust Response Factors, G_h and G_z (1)

Height above ground level (metres)	G_h (2) and G_z		
	Exposure A	Exposure B	Exposure C
0-4.5	1.654	1.321	1.154
6.0	1.592	1.294	1.140
9.0	1.511	1.258	1.121
12.0	1.457	1.233	1.107
15.0	1.418	1.215	1.097
18.0	1.388	1.201	1.089
21.0	1.363	1.189	1.082
24.0	1.342	1.178	1.077
27.0	1.324	1.170	1.072
30.0	1.309	1.162	1.067
35.0	1.287	1.151	1.061
40.0	1.268	1.141	1.055
45.0	1.252	1.133	1.051
50.0	1.238	1.126	1.046
60.0	1.215	1.114	1.039
70.0	1.196	1.103	1.033
80.0	1.180	1.095	1.028
90.0	1.166	1.087	1.024
100.0	1.154	1.081	1.020
110.0	1.114	1.075	1.016
120.0	1.134	1.070	1.013
130.0	1.126	1.065	1.010
140.0	1.118	1.061	1.008
150.0	1.111	1.057	1.005
160.0	1.104	1.053	1.003
170.0	1.098	1.049	1.001
180.0	1.092	1.046	1.000
190.0	1.087	1.043	1.000
200.0	1.082	1.040	1.000
220.0	1.073	1.035	1.000
240.0	1.065	1.030	1.000
260.0	1.058	1.026	1.000
280.0	1.051	1.022	1.000
300.0	1.045	1.018	1.000

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

১৩/১/১৫ - বিকাল

L-3/T-2/ARCH **Date : 06/01/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B.Arch. Examinations 2012-2013

Sub : **EEE 373** (Building Services (III) : Electrical Equipment)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) An RLC circuit as shown in-the Fig. 1(a), the instantaneous current, $i = I_m \sin\omega t$, flows through the circuit,

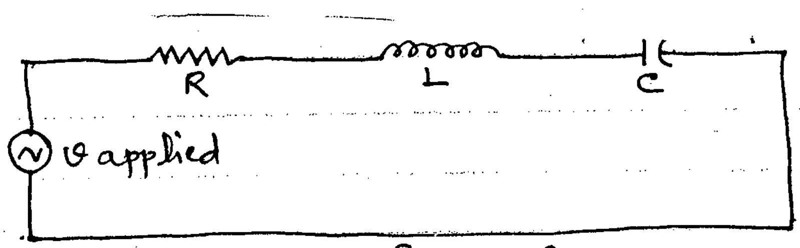


Fig. for Q 1(a)

Find the expressions for

(i) total voltage, v applied, if V_m is the maximum voltage **(6)**

(ii) the impedance, Z_{RLC}, **(3)**

(iii) the instantaneous power, and **(3)**

(iv) the real power and the reactive power. **(3)**

(b) Show that the maximum amount of energy stored by a pure capacitor C is $\frac{1}{2} CV_m^2$, where, I_m is the maximum current passing through the capacitor and V_m is the maximum value of voltage across the capacitor. **(8⅓)**

2. (a) What are the different types of Electrical wiring Systems presently practiced in the country. Describe any 5 (five) of them with necessary diagrams. **(12)**

(b) In view of Electrical Safety Measures, describe in-brief on "Safety of Men and Safety of Machine/Equipments". **(11⅓)**

3. (a) (i) What are the main reasons of, "Lightining Protection System" for very high-rise building ~~for~~ or important installations? **(3)**

(ii) Draw a Roof-Top Plan of a big high-rise building and show the detailed Lighting Protection System with earthing and down conductors involving for complete protection of the building. **(8⅓)**

(b)(i) Why is earthing so important? **(3)**

(ii) With simple diagrams describe in-short the main requirements for Earthing. **(4½)**

(iii) With simple diagrams, describe what are the common mistakes in installation of Earth Continuity conductors in case of different sizes of (Electric) Motors. **(4½)**

Contd P/2

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4. The same plan of a house are shown in Fig. 4(a) and Fig. 4(b),

   (a) Show the "Fittings and Fixture Layout Design" in Fig. 4(b) and attach this sheet with your answer script. **(14⅓)**

   (b) Show the Switch-Board Connection Diagram of the above design in your main Answer Script. **(5½)**

   (c) Show the Legends used in the above design, with short description. **(3½)**

SECTION – B

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

5. (a) Calculate the equivalent resistance R_{AB} in the circuit shown in Fig. for Q.5(a). Also calculate current I_o. **(10)**

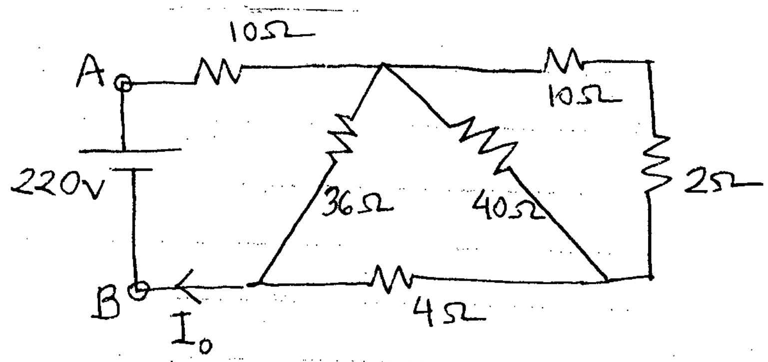

Fig. for Q. no. 5(a)

   (b) Using Delta-wye Transformation, find the current I_o in Fig. for Q. No. 5(b). **(13⅓)**

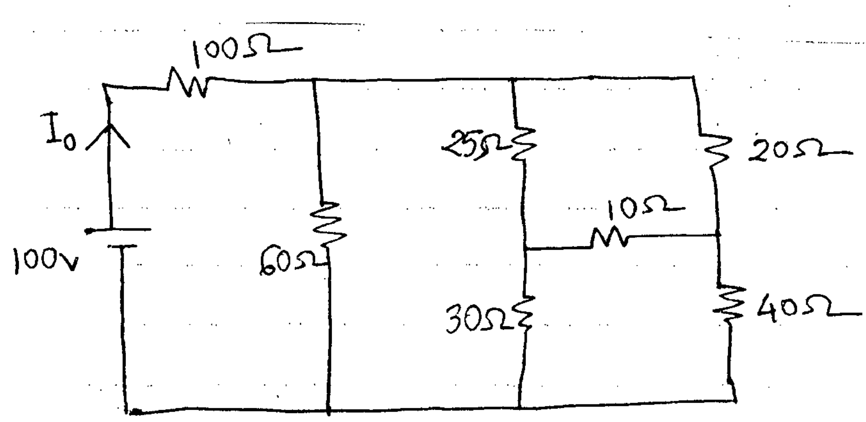

Fig. for Q. no. 5(b)

6. (a) Using branch current method, find the current in each branch of the network in Fig. for Q. No. 6(a). **(11)**

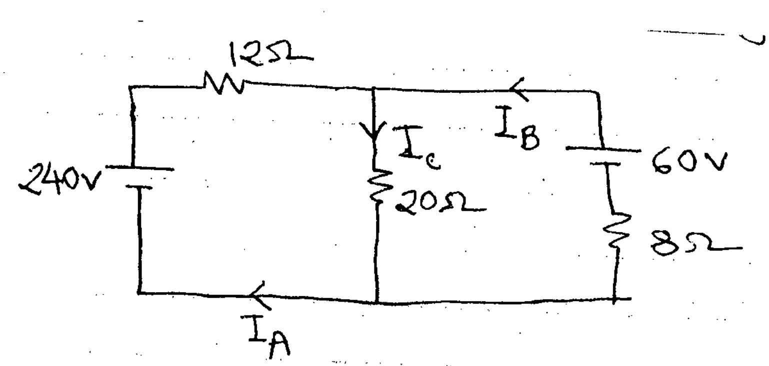

Fig. for Q. no. – 6(a)

EEE 373

6. (b) Calculate the loop current I_1, I_2, I_3, of the circuit in Fig. for Q. No. 6(b) **(12⅓)**

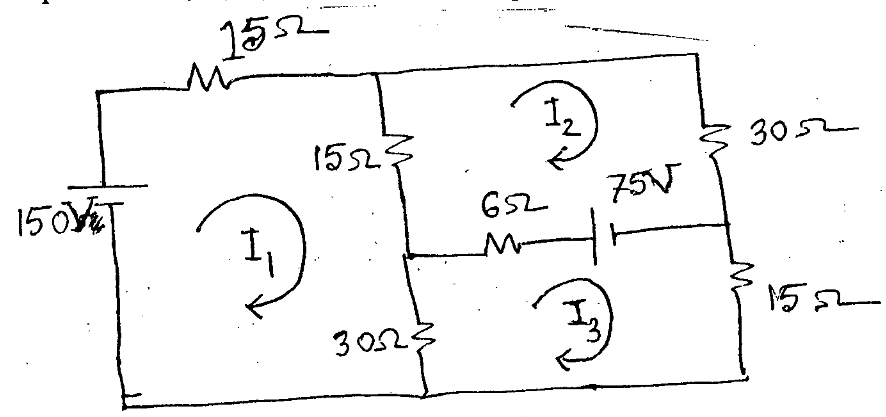

Fig. for Q no. - 6(b)

7. (a) A battery which gives 100A short circuit current, supplies 2.5A current to 3Ω resistance. What is the EMF of the battery? What is its internal resistance? **(8)**

(b) Using 'Superposition Principle', find the current in each branch of the circuit in Fig. for Q. No. 7(b). **(15⅓)**

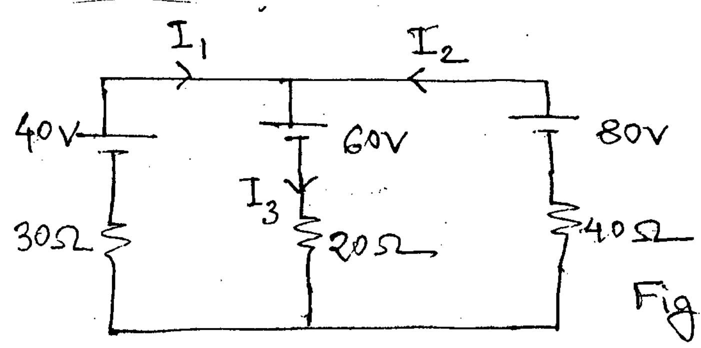

Fig. for Q no. - 7(b)

8. (a) Using 'Thevenin Theorem', find the current through the galvanometer with resistance 10Ω of the circuit in Fig. for Q. No. 8(a). **(12⅓)**

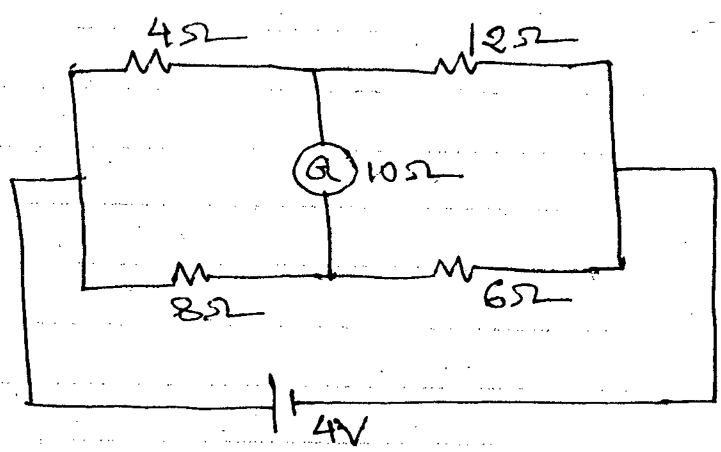

Fig. for Q. no. - 8(a)

(b) Using 'Norton Theorem', find the current in the branch AB of the circuit shown in Fig. for Q. No. 8(b). **(11)**

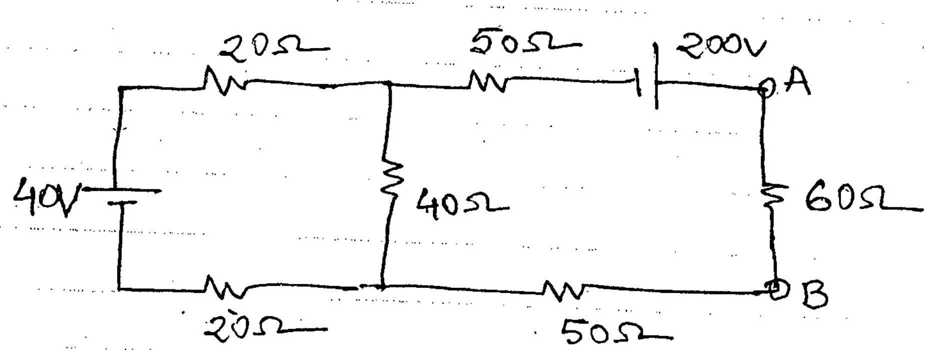

Fig for Q. no. 8(b)

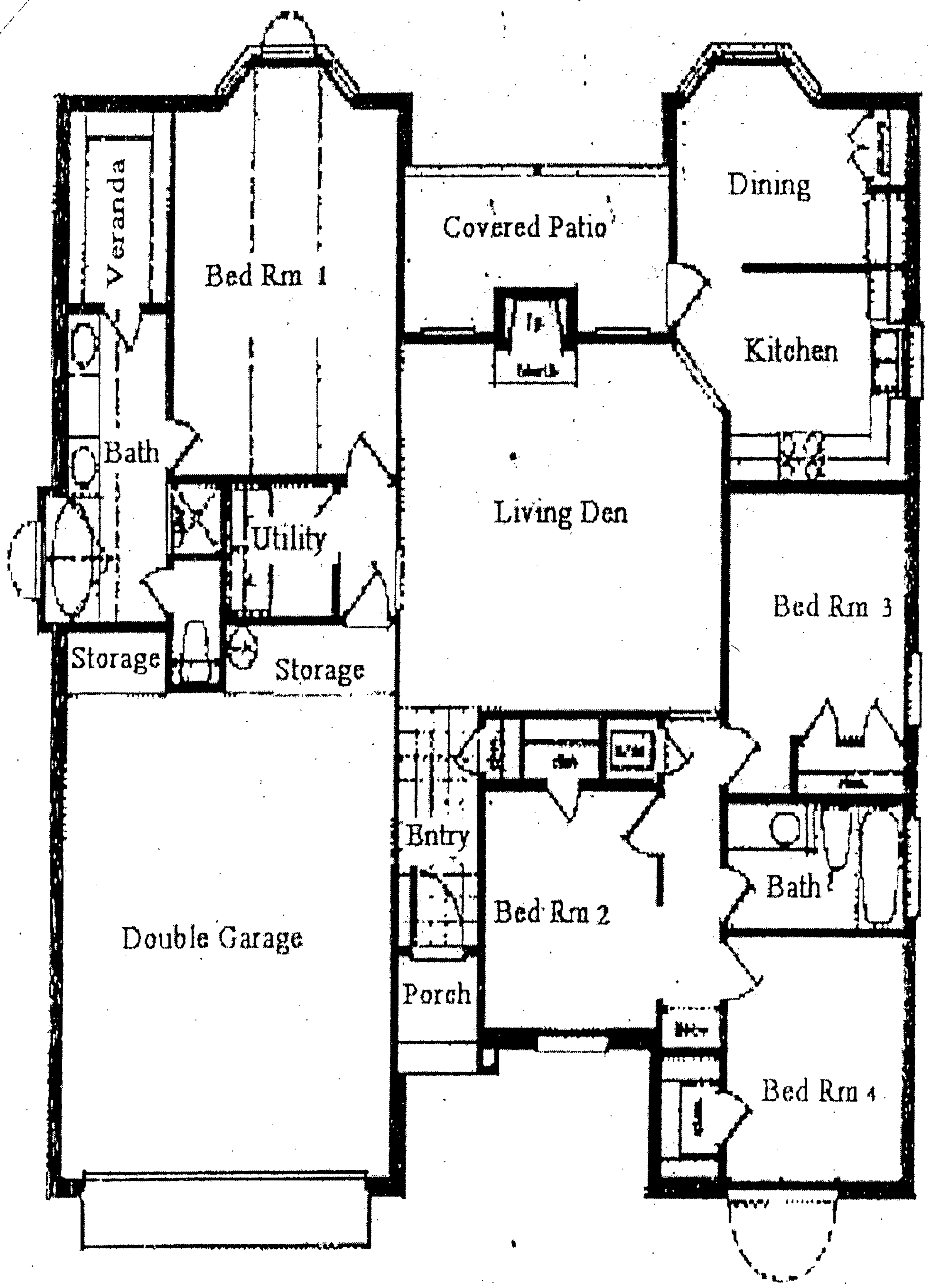

Fig. 4(a) for Q. No. 4

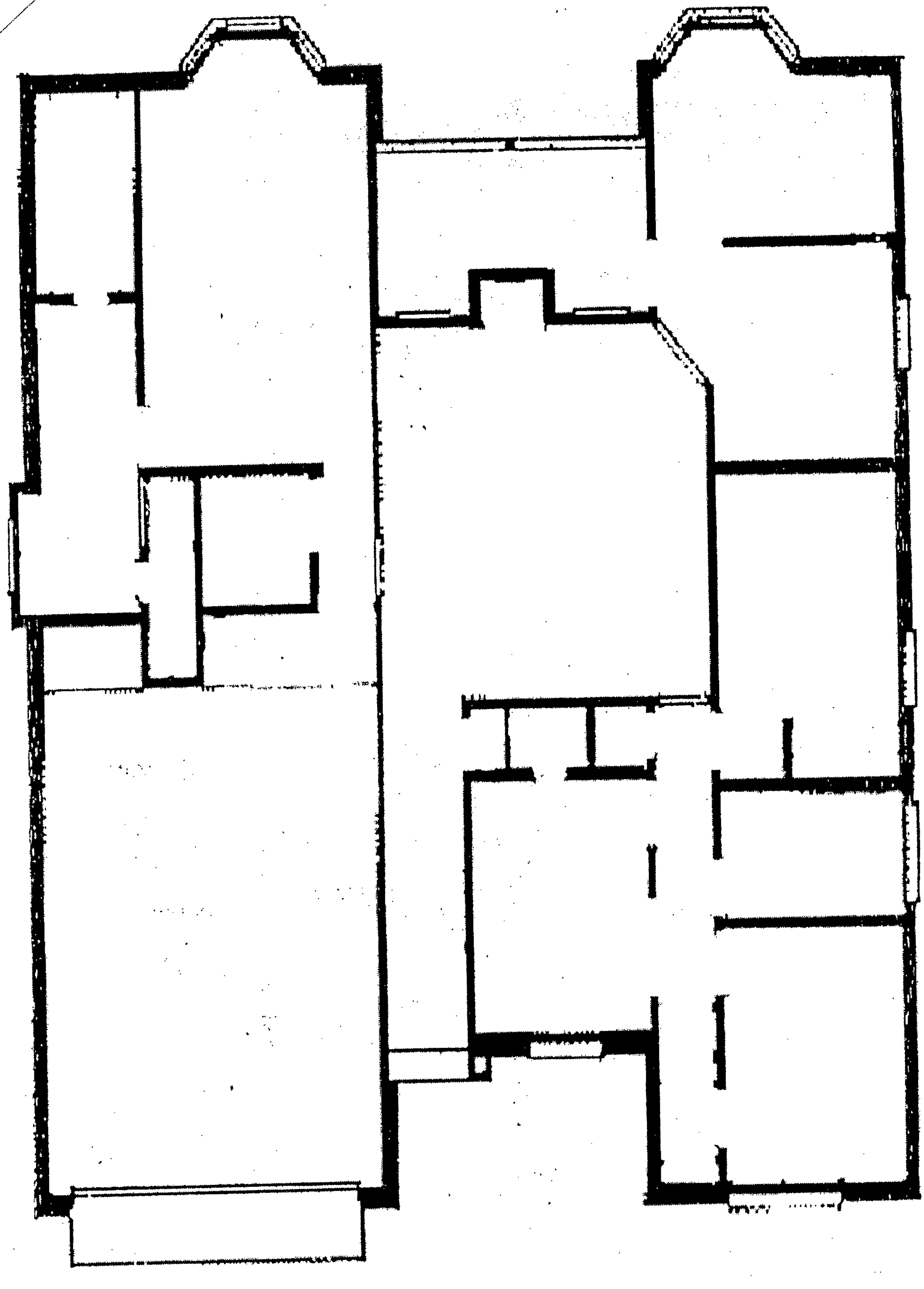

Fig. 4(b) for Q. No. 4

L-3/T-2/ARCH **Date : 11/01/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Arch. Examinations 2012-2013

Sub : **ARCH 397** (Interior Design)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer Q. No. **4** and any **TWO** from the rest.

1. What are the factors to be considered for interior flooring? Briefly describe (i) Wood flooring, (ii) Resilient flooring and (iii) Floor covering. **(22½)**

2. (a) How different types of wall influence the degree of separation and continuity in an interior space? Illustrate with sketches. **(12½)**

   (b) Describe any two types of wall finishes with sketches. **(10)**

3. (a) Discuss the relationship between volume and ceiling based on various ceiling types and forms. **(12½)**

   (b) How window types and their location influence natural lighting in an interior space? Elaborate with necessary sketches. **(10)**

4. Write short notes on the followings: (Any Five) **(5×5=25)**

   (a) Door types

   (b) Non-structural wood or metal frame walls

   (c) Types of window trim

   (d) Concrete and metal stairs

   (e) Door and space planning

   (f) Electrical systems and its impact on interior space.

SECTION – B

There are **FOUR** questions in this Section. Answer Q. No. **5** and any **TWO** from the rest.

5. (a) What do you understand by the term 'Interior Design'? Discuss its purpose. **(5)**

   (b) Explain the interior design process based on the following aspects: **(20)**

   (i) Programming

   (ii) Concept Development

   (iii) Design decision

   (iv) Implementation.

Contd P/2

ARCH 397

6. (a) What are factors that influence our visual perception? **(5)**

(b) Describe the co-relation of texture, light and pattern and their impact in interior spaces. **(17½)**

7. (a) Define 'Harmony'. What do you understand by unity and variety? Explain with necessary sketches. **(8)**

(b) What is the relationship between proportion and scale? Discuss visual scale and human scale. **(4½)**

(c) Explain three types of visual balance with sketches. **(10)**

8. (a) Define hue, value and intensity. Discuss colour based on the following attributes: **(10)**

(i) light

(ii) pigment

(b) What do you understand by worm colour and cool colour? Elaborate the impact of adjacent colours in an interior space with reference to simultaneous contrast. **(12½)**

L-3/T-2/ARCH **Date : 16/01/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. ARCH Examinations 2012-2013

Sub : **ARCH 353** (Urban Design I)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FIVE** questions in this Section. Answer Q. No. **5** and any **TRHEE** from the rest.

1. (a) Define the terms 'Urban', 'Urbanization', 'Urbanism', 'Urban Planning' and 'Urban Design'. **(10)**

   (b) Enumerate historical endeavours for responsive settlement design. **(7)**

2. (a) 'Greek Agora and Roman Republican Forum laid the foundation of urban design' discuss the statement with illustrate examples. **(12)**

   (b) Compare 'Chauk and Agora'. **(5)**

3. (a) Discuss the context and spatial transformation that took place during 19^{th} and 20^{th}. Century Urban design. Provide appropriate illustrations where necessary. **(10)**

   (b) Discuss with examples the 'linear' and 'Concentric' forms that evolved from the 19^{th} and 20^{th} century developmental context. **(7)**

4. (a) List the elements that are considered in an urban design endeavour. **(9)**

   (b) Elaborate on 'circulation and parking' including pedesterian ways. **(8)**

5. Write short notes on:

   (a) Quality of Environmental as the domain of Urban Design. **(9½)**

   (b) Travel Demand Analysis. **(9½)**

SECTION – B

There are **FIVE** questions in this Section. Answer Q. No. **10** and any **THREE** from the rest.

6. (a) Explain the 12 (Twelve) principles of a sustainable Urban Design. **(9)**

   (b) Discuss Principles of Urban Design in terms of 'Scale'. **(8)**

7. Urban Design's are to work at various Levels; List and discuss 'Basics' and 'Attributes' of Urban Design at each level. **(17)**

Contd P/2

ARCH 353

8. Elaborate on the domains of Urban Deign with which a professional Urban Designer deal with. Illustrate where necessary. **(17)**

9. (a) Discuss Non-measurable criterion in Urban Design. **(8)**

   (b) Compare 'San Francisco Urban Design Plan', Urban System Research and Engineering and Kevin Lynch's Concept. **(9)**

10. Write Short Notes (Any Two): **($9\frac{1}{2}$×2=19)**

    (a) External Form and Image

    (b) Measurable natural Criteria in Urban Design.

    (c) Elaborate Sequential phase relationship in Urban Design.

L-3/T-2/ARCH **Date : 11/01/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Arch. Examinations 2012-2013

Sub : **ARCH 377** (Urban Anthropology)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. Define anthropology. Briefly discuss the sub-field of anthropology. **(17½)**

2. Discuss the relationship between a theory of urbanism and sociological research. **(17½)**

3. "The focus and practices of anthropological research developed in differential -ways" - Explain. **(17½)**

4. Briefly describe the different research approaches of urban community study. **(17½)**

5. Write short notes on any TWO of the following: **(17½)**

   (a) Urban Microethnography.

   (b) Urban macroethnography.

   (c) Anthropological field work in cities.

SECTION – B

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

6. "The ultimate goal of architectural research is to provide a general inter-subjectivity acceptable knowledge about basic relation between architecture and man" - Explain this statement. **(17½)**

7. What do you understand by anthropological research? Write the more common types of anthropological research methods. **(17½)**

8. "Anthropologists try to appreciate all peoples and their culture and to discourage judgments of cultural superiority or inferiority" - Explain. **(17½)**

9. What is meant by cultural pluralism? Write the different features of cultural pluralism. **(17½)**

10. Write short notes on any two of the following: **(17½)**

    (a) Ethnology, Ethnography and Ethnomethodology

    (b) Architectural Anthropology and Habitat Research

    (c) Interview Technique

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