L-3/T-1/CE **Date : 19/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2016-2017

Sub : **CE 315** (Design of Concrete Structures I)

Full Marks : 210 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 USD Method of Design. Assume reasonable value for any missing data.

1. (a) Figure 1 shows the one-way reinforced concrete floor system of Civil Engineering Building, BUET. Design the one-way slab supported by beams cast monolithically with the slab. The slab is to carry a service live load (LL) of 60 psf in addition to its self-weight. Assume floor finish (FF) load of 30 psf and partition wall load of 50 psf. Given: f'_c = 3000 psi and f_y = 60,000 psi. Follow USD method and ACI moment co-efficients. Show the reinforcements in plan and section. **(25)**

   (b) Why are temperature and shrinkage reinforcement required in one-way slab? What are the recommended ratios for such steel? **(10)**

2. (a) Design the slab as two-way floor slab system, when there are no secondary beams B2 in the floor system of Fig. 1. The two-way slab panels are 25′ × 30′ in plan, supported by column-line beams only. Given: LL = 60 psf; FF = 30 psf; Pω = 50 psf; f'_c = 3 ksi and f_y = 60 ksi. Use moment co-efficient method. Show the reinforcements with neat sketches. **(20)**

   (b) Calculate the development length of 20 mm and 25 mm uncoated top bars in USD. Repeat the calculation for bottom bars also. Use f'_c = 3 ksi and f_y = 60 ksi and assume appropriate value for any missing data. **(9)**

   (c) What is the minimum length of lap for column splices as per ACI/BNBC code? **(6)**

3. (a) Determine both positive and negative reinforcements for the beam B1 supported on three columns as shown in Fig. 1. The beam B1 is to carry load from one-way slab given in question 1(a) above. Consider also the self-weight of the beam. The size of the beam is 12″ × 30″. Given: f'_c = 4 ksi; f_y = 72.5 ksi. Follow USD method. Show the reinforcements in long section. **(23)**

   (b) Show with neat sketches cut off or bend points for bars in approximately equal spans with uniformly distributed loads. **(8)**

   (c) What do you understand by the term "serviceability" in RC design? **(4)**

Contd P/2

CE 315

4. (a) Design the stirrups for the beam shown in Fig. 2. All loads are factored. Calculate the stirrups with 3 sets of spacings. Width of beam b = 12″ and effective depth d = 24″. Given: f'_c = 3.5 ksi and f_y = 60 ksi. **(26)**

   (b) What are the BNBC/ACI code provisions for beam stirrups (hoops) for moderate seismic risk region e.g. Dhaka. **(9)**

SECTION – B

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

5. (a) A singly reinforced rectangular section has 12 inch width and 24 inch total depth. The tension reinforcement consists of 3 No. 9 bar. *Given:* $f'_c = 3$ *ksi,* $E_c = 3200$ *ksi,* $f_r = 0.40$ *ksi,* $f_y = 60$ *ksi, and* $E_s = 29000$ *ksi. Allowable concrete stress,* $f_c = 0.45$ f'_c *and allowable steel stress,* $f_s = 24$ *ksi.* Determine, **(20)**

   (i) Cracking moment

   (ii) Maximum allowable working moment

   (b) Design a rectangular beam for 22 ft simple span if a dead load of 1 k/ft (not including the self-weight of the beam) and a live load of 2 k/ft are to be supported. Show rebar detailing in a neat sketch showing rebar size, arrangement and spacing. *Given:* $f'_c = 4$ *ksi and* $f_y = 60$ *ksi.* Assume, a beam section 12″ × 24″. **(15)**

6. (a) What is the purpose of providing minimum amount of flexural steel in beam? Write the ACI/BNBC code provisions for minimum reinforcement ratios. **(5)**

   (b) Give reasons for the minimum cover requirements in the ACI/BNBC code. What are the recommended values of 'cover' as per ACI/BNBC code? **(5)**

   (c) A RC beam section is limited to a width of 12 inch and total depth of 25 inch. Calculate the required reinforcement if the beam has to resist to a total factored moment of 625 k-ft including self-weight. Assume, two layer tensile reinforcement with d = 21 inch and d_t = 22.5 inch. Also, assume d′ = 2.5 inch, if compression steel is required. Show the rebar detailing in a neat sketch. *Given:* $f'_c = 4$ *ksi and* $f_y = 60$ *ksi.* **(25)**

7. (a) Distinguish between tension controlled and compression controlled beams. **(5)**

   (b) For the beam section shown in Fig. 3 determine whether the failure of the beam will be initiated by crushing of concrete or yielding of steel. *Given:* $f'_c = 4$ *ksi and* $f_y = 60$ *ksi.* **(10)**

   (c) Compute the stresses in the compression steel f'_s, for the doubly reinforced beam section shown in Fig. 4. Also compute the design moment strength for the section. Given: $f'_c = 4$ *ksi and* $f_y = 60$ *ksi.* **(20)**

Contd P/3

CE 315

8. (a) for the floor system shown in Fig. 5 calculate the effective width for the edge L-beam and T-beam AB. **(10)**

   (b) Determine the required reinforcement for the T-beam AB of the floor system shown in Fig. 5. Assume, simple supports at A and B. The floor is to support a live load of 80 psf, floor finish of 30 psf and partition wall load of 60 psf in addition to its self-weight. The slab is 4 inch thick, while d = 24 inch and b_w = 15 inch. *Given* $f_c' = 4$ *ksi and* $f_y = 60$ *ksi.* **(25)**

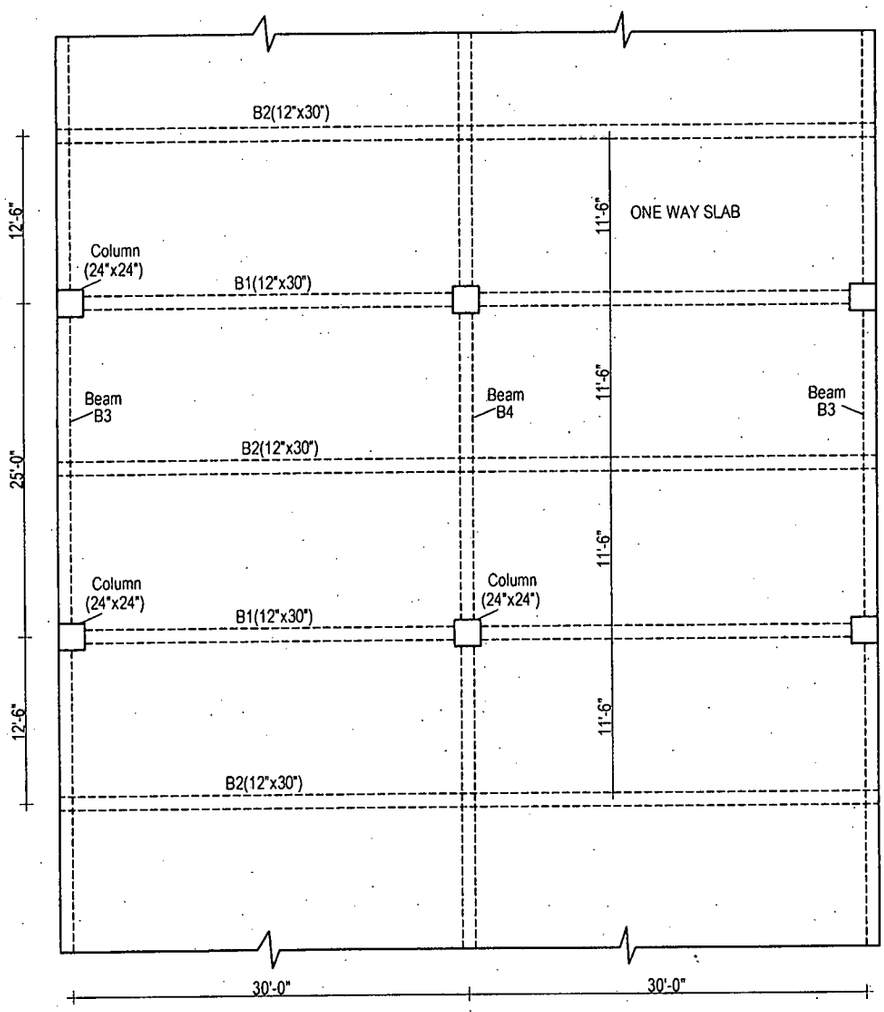
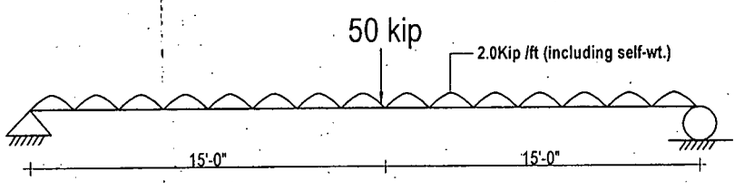


Fig- 1(Floor Slab of Civil Engineering Building)



ALL LOADS ARE FACTORED

Fig- 2

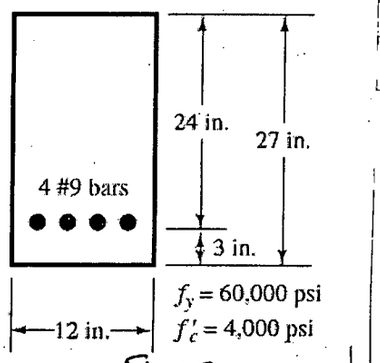


Fig : 3

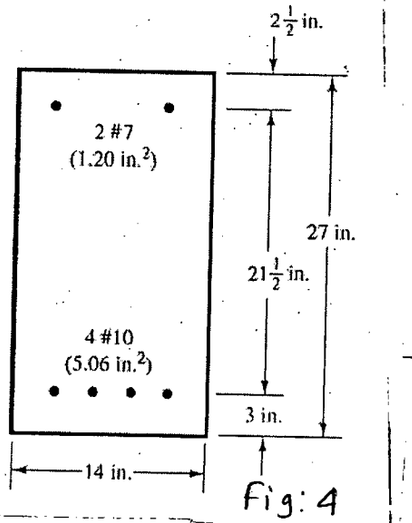


Fig : 4

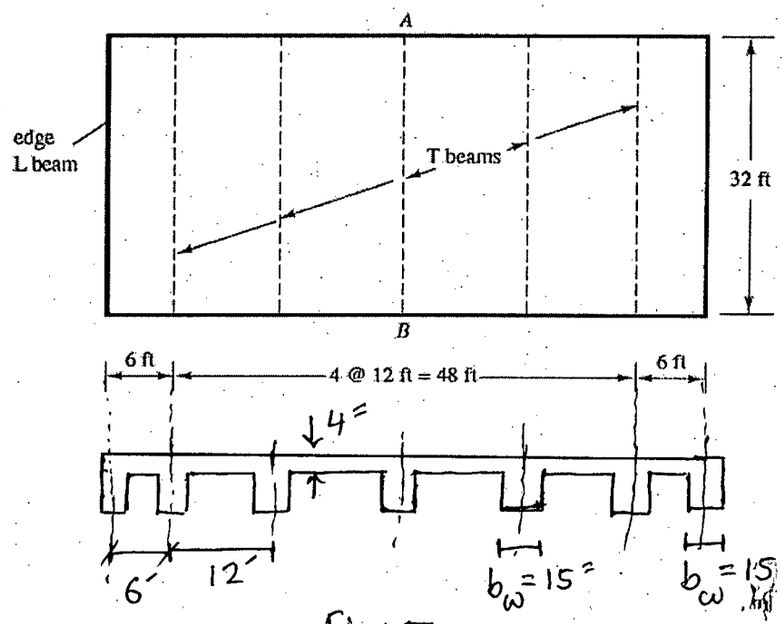


Fig : 5

Ⓐ Design of Concrete Structures - A. H. Nilson
12th Edition, Pages 408–411.

TABLE 12.3
Coefficients for negative moments in slabs[a]

$M_{a,neg} = C_{a,neg} w l_a^2$
$M_{b,neg} = C_{b,neg} w l_b^2$ where w = total uniform dead plus live load

Ratio $m = \frac{l_a}{l_b}$		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] A crosshatched 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 12.4
Coefficients for dead load positive moments in slabs[a]

$M_{a,pos,dl} = C_{a,dl} w l_a^2$
$M_{b,pos,dl} = C_{b,dl} w l_b^2$ where w = total uniform dead load

Ratio $m = \frac{l_a}{l_b}$		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] A crosshatched 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 12.5

Coefficients for live load positive moments in slabs[a]

$M_{a,pos,ll} = C_{a,ll} w l_a^2$

$M_{b,pos,ll} = C_{b,ll} w l_b^2$ where w = total uniform live load

Ratio $m = \frac{l_a}{l_b}$		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] A crosshatched 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.

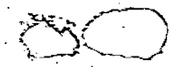


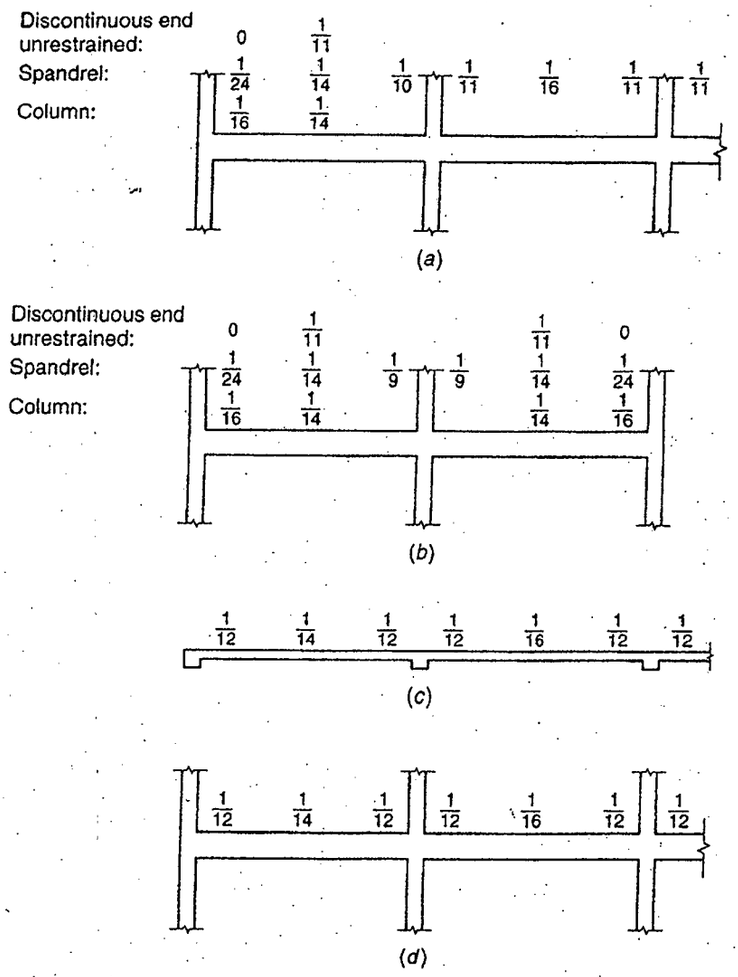
TABLE 12.6

Ratio of load W in l_a and l_b directions for shear in slab and load on supports[a]

Ratio $m = \frac{l_a}{l_b}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	W_a	0.50	0.50	0.17	0.50	0.83	0.71	0.29	0.33	0.67
	W_b	0.50	0.50	0.83	0.50	0.17	0.29	0.71	0.67	0.33
0.95	W_a	0.55	0.55	0.20	0.55	0.86	0.75	0.33	0.38	0.71
	W_b	0.45	0.45	0.80	0.45	0.14	0.25	0.67	0.62	0.29
0.90	W_a	0.60	0.60	0.23	0.60	0.88	0.79	0.38	0.43	0.75
	W_b	0.40	0.40	0.77	0.40	0.12	0.21	0.62	0.57	0.25
0.85	W_a	0.66	0.66	0.28	0.66	0.90	0.83	0.43	0.49	0.79
	W_b	0.34	0.34	0.72	0.34	0.10	0.17	0.57	0.51	0.21
0.80	W_a	0.71	0.71	0.33	0.71	0.92	0.86	0.49	0.55	0.83
	W_b	0.29	0.29	0.67	0.29	0.08	0.14	0.51	0.45	0.17
0.75	W_a	0.76	0.76	0.39	0.76	0.94	0.88	0.56	0.61	0.86
	W_b	0.24	0.24	0.61	0.24	0.06	0.12	0.44	0.39	0.14
0.70	W_a	0.81	0.81	0.45	0.81	0.95	0.91	0.62	0.68	0.89
	W_b	0.19	0.19	0.55	0.19	0.05	0.09	0.38	0.32	0.11
0.65	W_a	0.85	0.85	0.53	0.85	0.96	0.93	0.69	0.74	0.92
	W_b	0.15	0.15	0.47	0.15	0.04	0.07	0.31	0.26	0.08
0.60	W_a	0.89	0.89	0.61	0.89	0.97	0.95	0.76	0.80	0.94
	W_b	0.11	0.11	0.39	0.11	0.03	0.05	0.24	0.20	0.06
0.55	W_a	0.92	0.92	0.69	0.92	0.98	0.96	0.81	0.85	0.95
	W_b	0.08	0.08	0.31	0.08	0.02	0.04	0.19	0.15	0.05
0.50	W_a	0.94	0.94	0.76	0.94	0.99	0.97	0.86	0.89	0.97
	W_b	0.06	0.06	0.24	0.06	0.01	0.03	0.14	0.11	0.03

[a] A crosshatched 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.

Summary of ACI moment coefficients: (*a*) beams with more than two spans; (*b*) beams with two spans only; (*c*) slabs with spans not exceeding 10 ft; (*d*) beams in which the sum of column stiffnesses exceeds 8 times the sum of beam stiffnesses at each end of the span.



L-3/T-1/CE **Date : 15/07/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2016-2017

Sub : **CE 341** (Principles of Soil Mechanics)

Full Marks : 280 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable value (values) for missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) (i) What is block diagram and what are its uses? Using block diagram, establish the relationship among degree of saturation, void ratio, moisture content and specific gravity of soil skeleton. **(10+10+10=30)**

(ii) Why compaction tests are done in the laboratory? What is percent compaction and what is its use?

(iii) The in-situ porosity of a sand deposit is fifty percent. If the maximum and minimum dry densities of sand as determined from the laboratory test are 2.00 ton/m^3 and 1.20 ton/m^3 respectively, determine the density index. Assume $G_s = 2.74$. Indicate the state of compaction of sand deposit.

(b) For constructing an embankment, the soil is transported from a borrow area using truck which can carry 6 m^3 of soil at a time with the following details. Determine the number of truck loads of soil required to obtained 100 m^3 of compacted earth fill and the volume of borrow pit. **(16⅔)**

Property	Borrow area (in-situ)	Truck (loose)	Field (compacted)
Unit weight (kN/m^3)	16.6	11.5	18.2
Water Content (%)	8	6	14

2. (a) Write short notes on coefficient of volume compressibility, compression index coefficient of consolidation and swell index. **(20)**

(b) A circular rigid foundation block with 6.0 m diameter rests on a bed of compact sand of 5.0 m deep. It is subjected to a uniform pressure of 200 kN/m^2. Below the sand there is 1.6 m of clay overlying impervious rock. Ground water level (G.W.L) is 1.5 m below the surface of the sand. The unit weights of the sand above and below the G.W.L. are 19.2 kN/m^3 and 20.8 kN/m^3 respectively. The unit weight of clay is given as 19.9 kN/m^3. Draw a schematic diagram of the described problem. **(26⅔)**

Contd P/2

CE 341

Contd ... Q. No. 2(b)

A laboratory consolidation test performed on an undisturbed specimen of the clay of 20 mm thickness drained at the top and bottom gave the following results:

Pressure (kN/m^2)	50	100	200	300	400
Void ratio	0.730	0.680	0.625	0.580	0.540

(i) Estimate the settlement of the foundation, assuming that load spread may be taken as 1 horizontal to 2 vertical.

(ii) If the consolidation test, specimen reached 90% consolidation in 1 hour 46 minutes, how long it take for the foundation to reach 90% of its final settlement?

(iii) What would be the magnitude of **settlement**, if there exists a sand layer instead of impervious rock at the bottom of clay layer?

3. (a) (i) What is the principle of effective stress? How can you estimate the coefficient of permeability of clayey soil? Define seepage pressure. **(10+10=20)**

(ii) Derive the Laplace equation of continuity for two dimension flow problems in fully saturated soil. Write down the graphical and mathematical interpretations of this equation.

(b) A soil stratum with permeability, $k = 5 \times 10^{-7}$ cm/sec overlies an impermeable stratum. The impermeable stratum lies at a depth of 18 m below the ground surface (surface of the soil stratum). A sheet pile wall penetrates 8 m into the permeable soil stratum. Water stands to a height of 9 m on the upstream side and 1.5 m on downstream side, above the surface of soil stratum. Saturated unit weight of soil is given as 20.4 kN/m^3. For the aforementioned problem the flow net diagram is shown in Fig. 1. Determine, **(26⅔)**

(i) Quantity of seepage loss in one month,

(ii) Seepage pressure and pore water pressure at a point "P",

(ii) Pore water pressure and effective stress at a point "Q", and

(iv) Factor of safety against up heaving using Terzaghi's and Harza's criteria.

4. (a) Derive Terzaghi's 1-D consolidation equation. Clearly state the assumptions you made and their application in deriving 1-D consolidation equation. Also clearly state their limitations. **(26⅔)**

(b) Write down the step by step procedure to calculate degree of consolidation for sand drains using Barron's Chart. **(20)**

Contd P/3

CE 341

SECTION – B

There are **EIGHT** questions in this section. Answer any **SIX**.

5. The following results on consistency tests are available for two fine grained soils A and B. **(23 1/3)**

Test	Soil A	Soil B
Liquid Limit	52	30
Plastic Limit	19	32
Flow Index	11	6
Natural Water Content	32	40

Which soil is – (a) more plastic; (b) better foundation material on remoulding; (c) better shear strength as a function of water content: (d) better shear strength at plastic limit. Also, do the appropriate classification of Soil A based on the data provided.

6. A saturated clay sample was obtained from the field without allowing the water content and the void ratio to change. The sample was subjected to the following stresses in the field; $\sigma = 240\ kN/m^2$; $u = 140\ kN/m^2$; $\sigma' = 100\ kN/m^2$ **(8 1/3 +5×3)**

(a) On sampling what are the total, effective and porewater stresses acting on it? The sample was then placed in a triaxial cell and was subjected to a cell pressure of 100 kN/m^2.

(b) What are the total, effective and porewater stresses acting on it now?

The cell pressure was then raised to 320 kN/m^2 with the drainage valves closed.

(c) What are the total, effective and porewater stresses acting on it now?

The drainage valves were then opened and the soil is allowed to consolidate under a cell pressure of 320 kN/m^2.

(d) What are the total, effective and porewater stresses acting on it now?

7. A drained triaxial compression test for a normally consolidated clay specimen was conducted with a cell pressure of 100 kPa. After the test, the failure plane on the specimen was observed. The failure plane angle was measured as 55° inclined with the horizontal. What are the effective angle of internal friction and magnitude of deviator stress at failure? **(23 1/3)**

8. Compute the lateral earth pressure against the basement wall as shown in Figure 2. The dimensions and parameters are as follows: **(23 1/3)**

For Layer 1 : $H_1 = 2$ m, $\gamma_1 = 16.5\ kN/m^2$, $\varphi_1 = 33°$, $OCR_1 = 1$

For Layer 1 : $H_2 = 4$ m, $\gamma_2 = 18.5\ kN/m^2$, $\varphi_1 = 35°$, $OCR_2 = 2$

Contd P/4

CE 341

Contd ... Q. No. 8

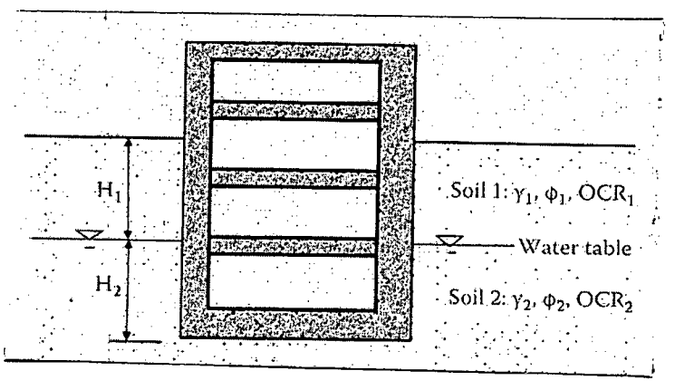


Fig: 2

9. A cohesive soil was tested in a consolidated undrained triaxial test with pore pressure measurement, and $\varphi = 24°$and c = 26 kPa in the total stress and $\varphi' = 27°$ and $c' = 30$ kPa were obtained. If the similar specimen were tested under cell pressure of 45 kPa, **(23 1/3)**

   (a) What would have been the failure deviator stress?

   (b) What would have been the pore water pressure at failure?

10. State the assumptions used in Rankine's theory of earth pressure. Deduce a formula for active earth pressure due to a c-φ backfill and hence derive an expression for theoretical unsupported height in a purely cohesive soil. **(23 1/3)**

11. After a series of a laboratory tests, the following data were established for a fine soil. **(7+7+9 1/3)**

    Liquid limit = 38

    Clay content (particles less than 0.002 mm) = 24.2%

    Dry length of sample in linear shrinkage test = 129 mm

    Percent passing 0.075 mm sieve = 40

    Natural moisture content = 29

   (a) Calculate the activity of the soil.

   (b) Calculate the liquidity index and comment on the consistency state of the soil.

   (c) Describe the soil as per AASHTO classification system.

12. In an undrained triaxial test on a specimen of normally consolidated clay at a cell pressure of 150 kPa, the ultimate deviator stress was 260 kPa and ultimate pore pressure was 50 kPa. Draw the appropriate shear strength envelope, and – **(9 1/3 +7+7)**

   (a) determine the parameter φ', and

   (b) determine the undrained shear strength, c_u.

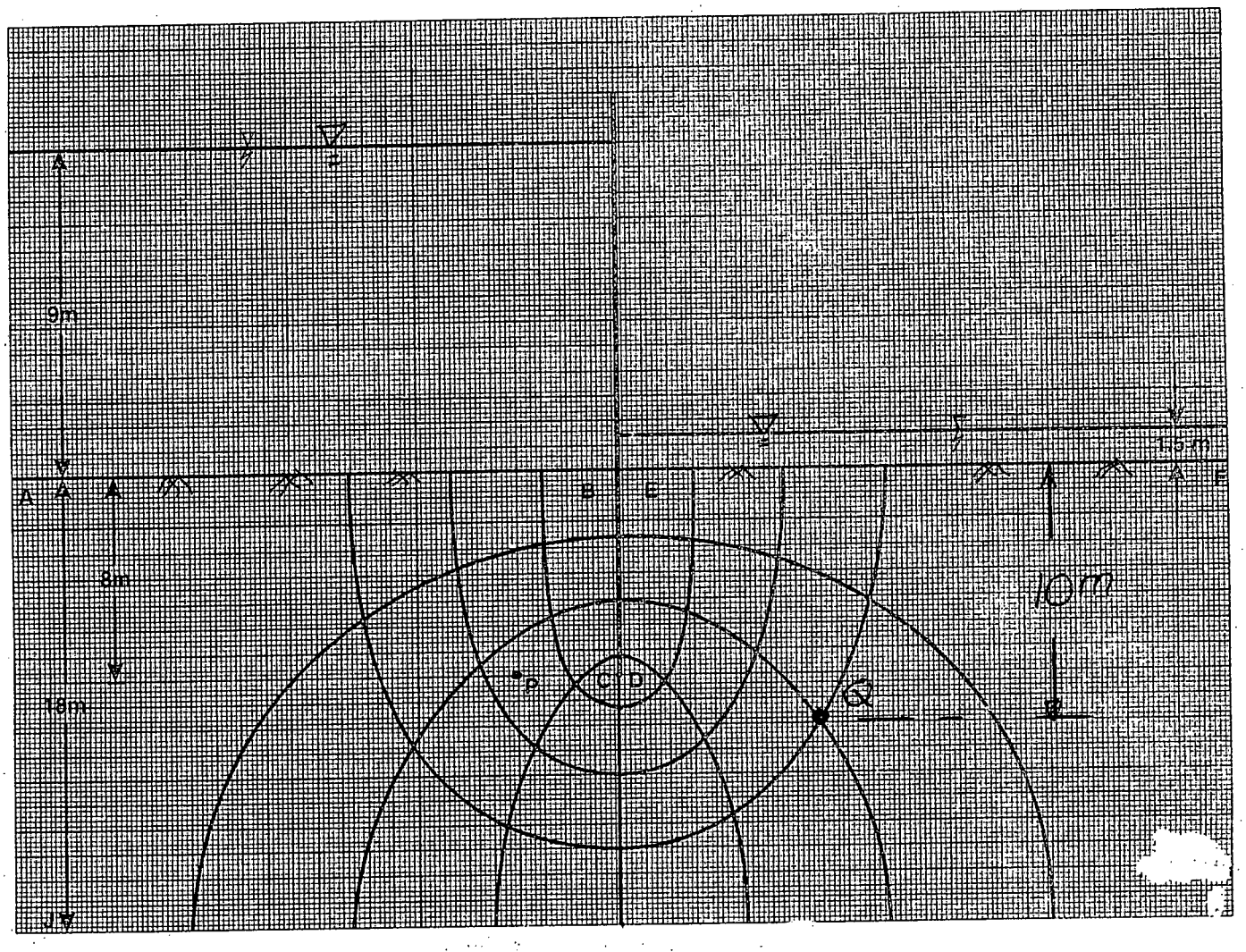
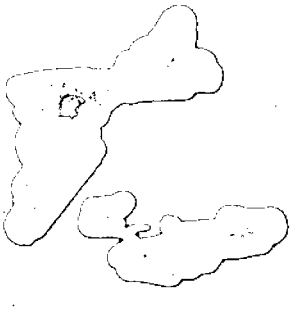


Fig. 1



L-3/T-1/CE **Date: 13/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2016-2017

Sub: **CE 311** (Structural Analysis and Design-I)

Full Marks: 280 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

The questions are of equal value.

1. Calculate vertical deflection at joint "b" of the truss shown in Fig. 1. Given: A = 10 in^2 for all members and E = 30,000 ksi.

2. Determine change in slope at support "A" of the beam shown in Fig. 2. Given: I_1 = 200 in^4 (AC) and I_2 = 100 in^4 (CD) and E = 30,000 ksi.

3. For the Frame shown in Fig. 3, find vertical deflection at B. Given: A = 10 in^2, I = 400 in^4 for all members and E = 30,000 ksi.

4. Determine hanger force and draw shear force and bending moment diagram for the Girders of the suspension bridge shown in Fig. 4.

5. For the wheel loads shown in Fig. 5, find maximum moment at quarter point of a simply supported beam of 80 ft.

6. Compute maximum shear at one-third point of a simply supported beam of 72 ft due to the wheel loads shown in Fig. 5.

7. Calculate maximum compression in member "a" of the truss and the wheel loads shown in Fig. 6.

SECTION-B

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

The figures in the margin indicate full marks.

Assume reasonable values of missing data.

8. (a) For the pin-jointed truss shown in Figure 7, determine the forces in members 18, 26, 35 and 56 caused by the applied loads. **(24)**

Contd P/2

CE 311

Contd... Q. No. 8

(b) The span and rise of an arch are 16 m and 4 m, respectively. The equation of the three-hinged parabolic arch is $y = 4h*\left(Lx - x^2\right)/L^2$ with the origin at the left support and x-axis directed towards the right and y-axis upwards. A uniformly distributed load of 12 kN/m is applied on the left half of the arch as shown in Figure 8. Calculate the values of normal force, shear force and bending moment at the point D which is located at a distance 6 m from the left support. **(22⅔)**

9. (a) Draw the axial force, shear force and bending moment diagrams for the building frame loaded as shown in Figure 9. **(28⅔)**

(b) Determine the bar forces in members "x", "y" and "z" of the truss shown in Figure 10 assuming that the diagonals cannot support compressive forces. **(18)**

10. (a) Draw influence line diagram for (a) Reaction at B (b) shear just left of D and (c) Moment at C of the beam shown in Figure 11. **(18)**

(b) Draw the shear force and bending moment diagrams of the beams and columns for the building frame as shown in Figure 12. Use Portal method. **(28⅔)**

11. (a) Using Cantilever method, draw the bending moment diagrams of the beams and columns for the building frame as shown in Figure 13. Relative column cross-sectional areas are given beside the columns. **(30⅔)**

(b) For the truss shown in Figure 14, draw influence line diagram for bar force in members "a" and "b". **(16)**

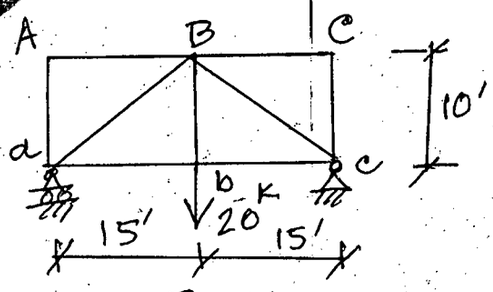


Fig. 1

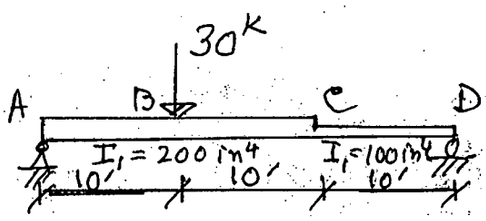


Fig. 2

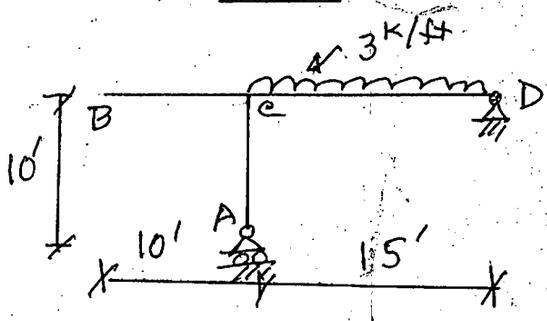


Fig. 3

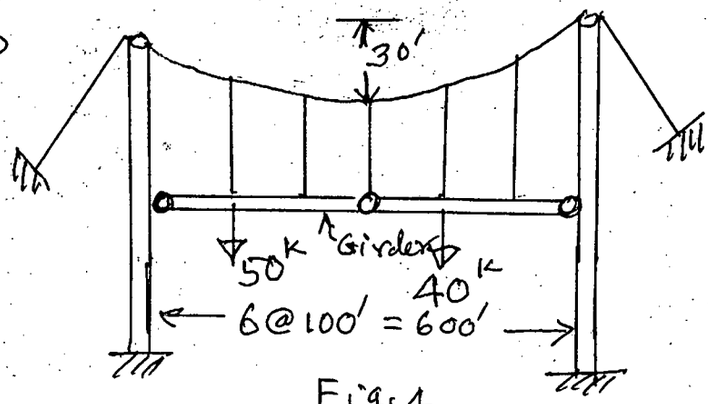


Fig. 4

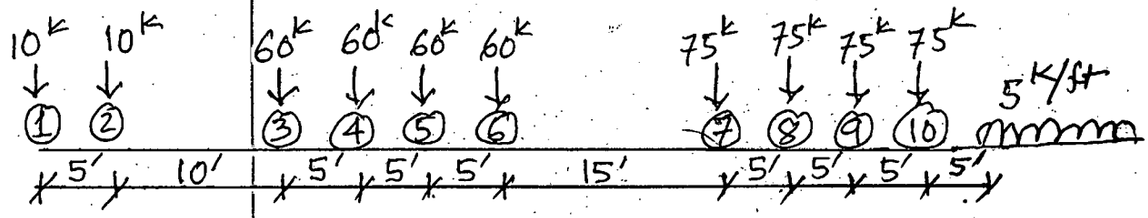


Fig. 5

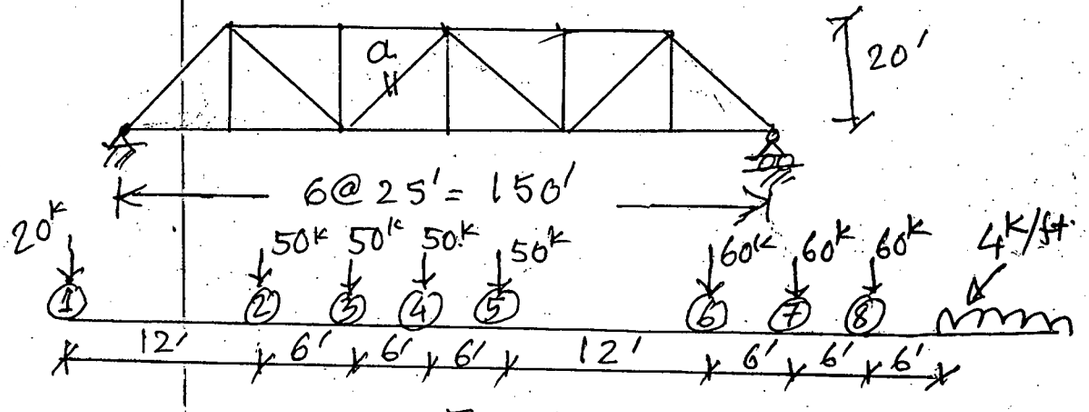


Fig. 6

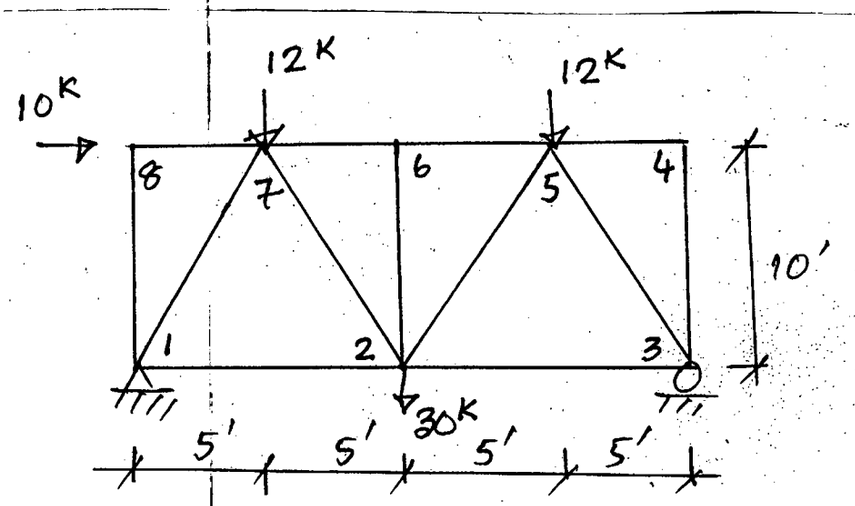


Figure 7

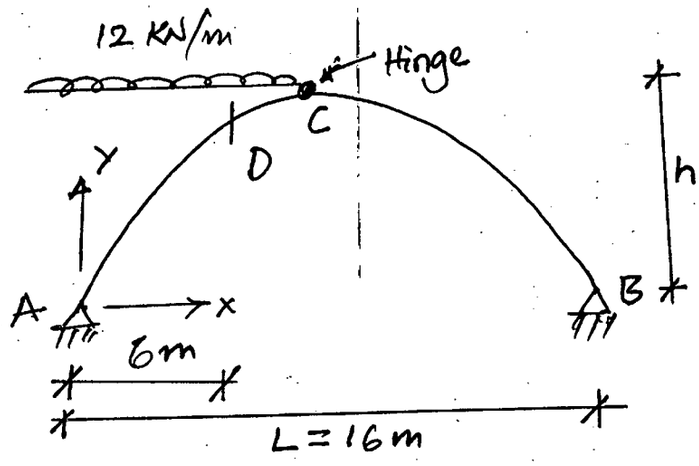


Figure 8

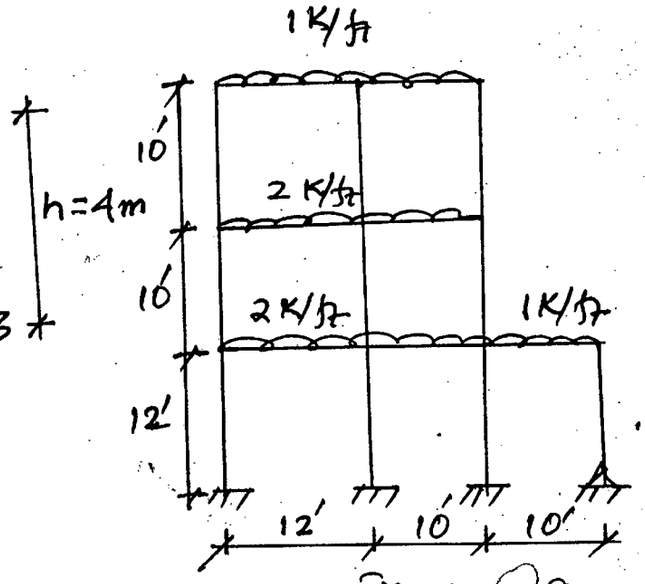


Figure 9

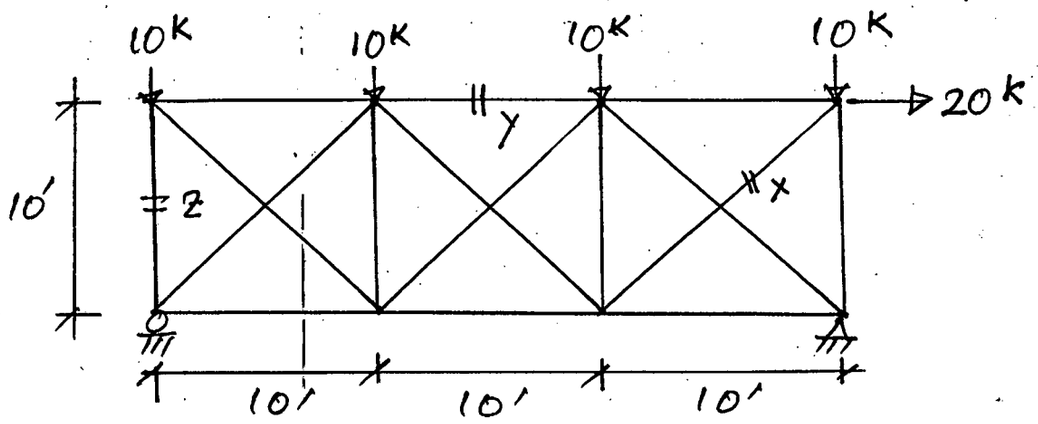


Figure 10

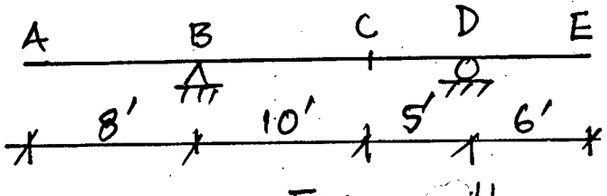


Figure 11

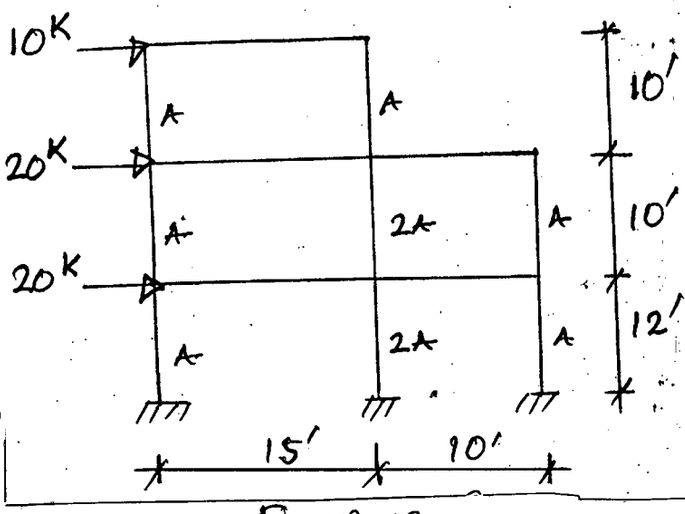


Figure 13

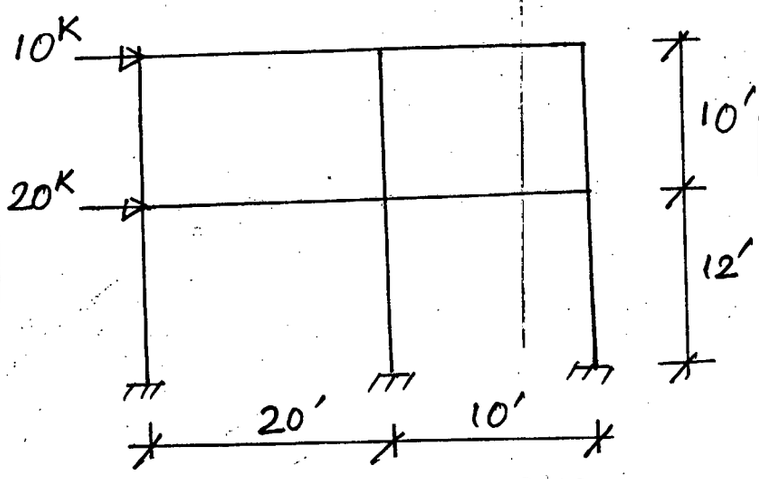


Figure 12

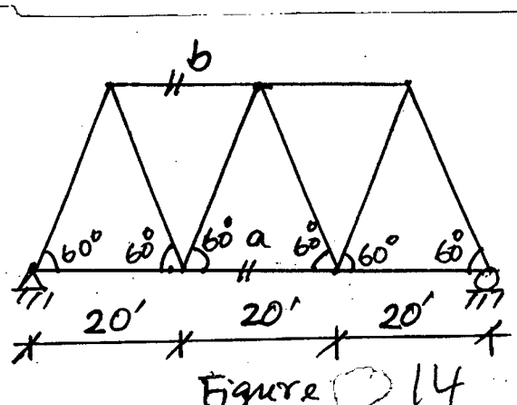


Figure 14

L-3/T-1/CE **Date : 08/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2016-2017

Sub : **CE 331** (Environmental Engineering I)

Full Marks : 210 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) What do you mean by the term 'climate change'? Briefly explain the causes of climate change. What are the general impacts of climate change in Bangladesh? **(17)**

   (b) Describe the factors affecting per capita demand of water. The population of a city was 24 million in 1970, 28 million in 1980, 37.5 million in 1990, 52 million in 2000 and 72 million in 2010. Estimate the probable population of the city in 2030 by geometric progression method and the change in increase rate method, respectively. **(18)**

2. (a) Why is the hydrologic cycle important? Explain with a diagram. What do you mean by 'UFW'? Briefly explain the transmission of diseases from faeces. **(18)**

   (b) State the hydraulics of groundwater flow towards a well. Deduce the mathematical expression for the yield of a well in an unconfined aquifer. **(17)**

3. (a) Design a tubewell with the following sieve analysis data of a soil sample: **(17)**

Sieve No.	Sieve size (mm)	wt. of material retained (gm)
30	0.60	0.3
40	0.425	1.2
50	0.30	20.8
100	0.15	69.4
200	0.075	7.2
Pan	---	1.1

   The diameter of the strainer is 150 mm and the opening area of the strainer is 13% of the total surface area of the strainer.

   (b) How does Manganese Oxidation, Precipitation and Adsorption Process differ from Iron Oxidation, Precipitation Processes of water treatment? What are the two objectives of 'Aeration' process and how does gas transfer through air-water interface can be maximized? Draw a neat sketch of reverse rotary recirculation method of drilling wells. **(18)**

4. (a) What are the sanitary significance of the following impurities in water? (i) SO_4, (ii) Hardness, (iii) Do and (iv) Mn. What are the mechanisms of removal of turbidity and microorganisms from water through granular media filtration? Explain very briefly with diagram. **(18)**

Contd P/2

CE 331

Contd ... Q. No. 4

(b) Show the variation of Carbonic Acid Species (Natural Acidity, Bi-carbonate, Carbonate etc.) with pH value. Under which environmental conditions soda ash is used and re-carbonation is required in a 'Precipitation Softening Process? How does Activated Carbon Adsorption Process differ from "Ion Exchange Process"? What are the advantages of GAC over PAC? **(17)**

SECTION – B

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

5. (a) What are the sources of the following impurities in water? **(8)**

   (i) E. Coli (ii) Lead (iii) H_2S and (iv) NO_3

   (b) Explain briefly the three disinfection mechanisms (hypothesis) with diagram. **(9)**

   (c) What do you mean by 'Camp Number' in a Flocculation Process? What are the factors affecting coagulation process? **(8)**

   (d) What are the advantages of "Inclined Parallel Plates Separator" over single storied "Plain Settling Tank"? – Show with diagram. How does "Reverse Osmosis" process differ from "Electro-dialysis" process? **(10)**

6. (a) How do pH value and alkalinity of water affect "Precipitation Softening Process"? **(10)**

   (b) How is Arsenic removal affected by pH value and presence of iron in water? **(10)**

   (c) An elevated cylindrical water tank of 2 lac US. gallons capacity has to be designed. If concrete work per sft in the floor and wall of shell costs Tk. 500/- and Tk. 750/- respectively, determine the most economic dimension of the water tank. **(15)**

7. (a) What are the objectives of "Water Safety Plan"? **(8)**

   (b) What are the characteristics of centrifugal pumps? State with necessary diagrams. **(10)**

   (c) Design the transmission main and the pumping unit from the following data: **(17)**

   Water supply rate = 40 gpcd
   Population = 2.5 million
   Static head = 100 ft
   Velocity through pipes = 10 fps
   Length of pipe = 3000 ft
   Friction factor = 0.01
   Combined efficiency = 65%
   Pumping hour = 10 hour/day
   Neglect minor losses.

8. (a) What are the factors to be considered in locating and designing an Intake? **(12)**

   (b) What is water hammer? Explain the phenomenon of water-hammer by suitable sketches? How can you reduce the water-hammer effect in water works practices? **(12)**

   (c) What are the basic assumptions made in the Hardy-Cross method of computing flow distribution in a pipe network? State the procedure of Hardy-Cross method with a sketch of two loop network. **(11)**

L-3/T-1/CE **Date : 02/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2016-2017

Sub : **CE 301** (Professional Practice and Communication)

Full Marks : 210 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) In connection with the preparation of a tender document for construction of a twenty storied building with an estimated cost of Tk. fifty crore and project duration four years, prepare the tender data sheet (TDS) for the following items: **(20)**

   (i) Genera Experience (ii) Specific Experience (iii) Tender Security (iv) Turnover (v) Liquid Asset.

   (b) For the work mentioned above, prepare a standard Notification of Award (NOA) to the winning tenderer. **(15)**

2. (a) Establish the relationship between GCC and PCC clauses with respect to following items: **(25)**

   (i) Completion Time (ii) Liquidated Damage (iii) Compensation Events (iv) Retention (v) Arbitration

   (b) Write specification for concrete works in building. **(10)**

3. (a) What is the purpose of having a procurement plan. In a standard format, prepare a procurement plan on behalf of a procuring entity. **(10)**

   (b) Write the steps involved in the evaluation of tender. **(15)**

   (c) For the award of a job under intellectual service procurement by QCBS method, the technical weightage is 80% with a qualifying mark of 75%. Compute combined score and ranking of the firms for the award of the contract. Following information has been obtained after evaluation: **(10)**

Firm	Technical Score (100)	Finantial Proposal Value (Tk.)
A	70	-
B	85	2 crore
C	90	2.5 crore
D	80	2 crore

4. (a) Define 'Civil Engineers as per ASCE Body of Knowledge. **(5)**

   (b) Briefly describe five attributes of civil engineering profession. **(10)**

   (c) What are project characteristics? **(10)**

   (d) What are the 'Think Twice' contract clauses? **(10)**

Contd P/2

CE 301

SECTION – B

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

5. (a) Describe the steps for preparing an effective oral presentation. **(17)**

   (b) What are the different types of communication activities of an organization? Describe them briefly. **(18)**

6. (a) List in detail the different parts of a business proposal. **(17)**

   (b) Why do problems in communication occur? Explain Abstracting and Inferring. Describe different types of non-verbal communication. **(18)**

7. (a) Define project. Briefly describe scope-Schedule-Budget triangular relationship. List the elements of contract law that make a contract binding. **(17)**

   (b) Draw the flow of work in project development. Briefly discuss different types of contract format in project delivery. **(18)**

8. (a) Briefly discuss, **(17)**

   (i) General liability Insurance
   (ii) Employment practices liability insurance
   (iii) Fiduciary risk
   (iv) Bid bond
   (v) Multiple prime

   (b) What are the activities one needs to follow while dealing with contract risk? List the specific concerns of professional liability insurance. **(18)**
