4-1

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2019
Program: B. Sc. Engineering (Civil)

Course Title: Project Planning & Management | Course Code: CE 401
Time: 1 Hour | Full Marks: 20

[Assume Reasonable Values for Any Missing Data]

SECTION – A

1. Read the following the case and answer the questions below in brief:

To reduce the cost and improve the value and service of its employee benefits coverage, the management committee of Shah Alam Medical Center decided to procure and implement a new benefits system. The new system would have to meet four goals: improved responsiveness to employee needs, added benefits flexibility, better cost management, and greater coordination of human resource objectives with business strategies. A multifunctional team of 13 members was formed with representatives from the departments that would rely most on the new system—Human Resources (HR), Financial Systems (FS), and Information Services (IS). Representation from these departments was important to assure all of their needs would be met. The team also included six technical experts from the consulting firm of Hun and Bar Software (HBS).

Early in the project a workshop was held with team members from Shah Alam and HBS to clarify and finalize project objectives and develop a project plan, milestones, and schedule. Project completion was set at 10 months. In that time HBS had to develop and supply all hardware and software for the new system; the system had to be brought on-line, tested, and approved; HR workers had to be trained how to operate the system and load existing employee data; all Shah Alam employees had to be educated about and enrolled in the new benefits process; and the enrollment data had to be entered in the system.

The director of FS was chosen to oversee the project. She had the technical background and had previously worked in the IS group in implementing Shah Alam's patient care information system. Everyone on the team approved of her appointment as project leader, and many team members had worked with her previously. To assist her she selected two team leaders, one each from HR and IS. The HR leader's task was to ensure that the new system met HR requirements and the needs of Shah Alam employees; the IS leader's task was to ensure that the new software interfaced with other Shah Alam systems.

Members of the Shah Alam team worked on the project on a part-time basis, spending roughly 50 percent of the time on the project and the rest on their normal daily duties. The project manager and team leaders also worked on the project part-time, although when conflicts arose the project took priority. Shah Alam's top-management committee had made it clear that meeting project requirements and time deadlines was imperative. The project director was given authority over functional managers and project team members for all project-related decisions.

(a) The project manager is also the director of FS, only one of the departments that will be affected by the new benefits system. Does this seem like a good idea? What are the pros and cons of her selection? **(3)**

(b) Comment on the team members' part-time assignment to the project and the expectation that they give the project top priority. **(3)**

(c) Much of the success of this project depends on the performance of team members who are not employed by Shah Alam, namely the HBS consultants. They must develop the entire hardware/software benefits system. Why was an outside firm likely chosen for such an important part of the project? What difficulties might this pose to the project manager in meeting project goals? **(4)**

SECTION – B

2. (a) What is slack time in a project? **(1)**

(b) Develop the network for a project with following activities and immediate predecessors and find the critical path. **(4)**

Activity	Immediate Predecessor	Duration (Hours)
A	-	2
B	-	6
C	-	4
D	A	3
E	C	5
F	A	4
G	B, D, E	2

3. (a) What is inventory turns? Write down the disadvantage of low inventory turns. **(2)**

(b) A boutique store predicts the demand and orders a specific amount of dresses for Eid sale. The procurement cost of each dress is 1000 taka. The store gains 80% profit during the season and offers 50% discount after Eid. If the average demand of the previous years is 3000 and the standard deviation is 1000, determine the optimum quantity of dresses the store should order to avoid overage or underage. Use the following table if necessary. **(3)**

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Spring 2019
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering III		Course Code: CE 411
Time: 1 hour	Credit Hour : 3.0	Full Marks: 4 x 10

ANSWER ALL QUESTIONS. Any missing data can be assumed reasonably.

1. Ignore zero-force members of the space truss ***abcdefghij*** shown in ***Fig.1*** and apply boundary conditions to formulate stiffness matrix and load vector
[Given: S_x = 1100 k/ft, Nodal Coordinates (ft) are *a*(0,0,0), *b*(0,10,0), *c*(0,20,0), *d*(0,0,–8), *e*(0,10,–8), *f*(0,20,–8), *g*(12,10,0), *h*(12,20,0), *i*(12,10,–8) and *j*(12,20,–8)].

2. Use stiffness method (neglect axial deformations) to calculate rotations of joints *c* and ***d*** of the frame ***abcd*** loaded as shown in ***Fig.2***
[Given: EI = 50×10^3 k-ft^2].

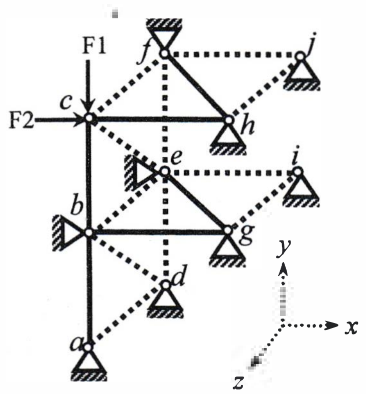


Fig.1

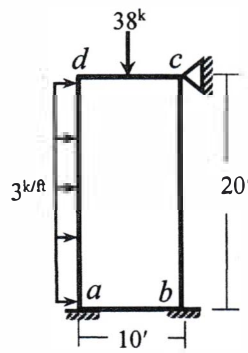


Fig.2

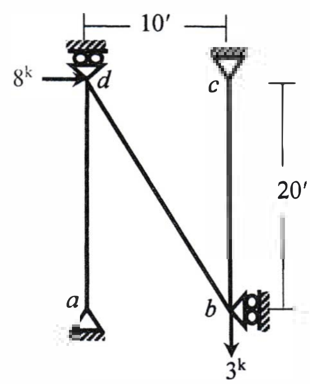


Fig.3

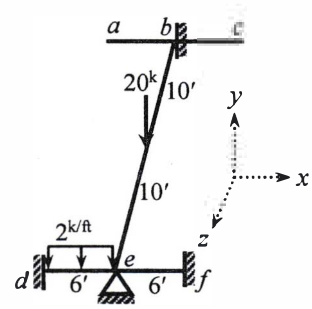


Fig.4

3. Identify zero-force members of the truss ***abcd*** loaded as shown in ***Fig.3.*** Determine the displacements of joints ***b*** and ***d***. Also calculate member forces
[Given: EA/L =1000 k/ft].

4. Use stiffness method to calculate rotation(θ_x,θ_z) of joint ***e*** of the grid system ***abcdef*** loaded as shown in ***Fig.4***
[Given: EI = 20×10^3 k-ft^2 and GJ = 5×10^3 k-ft^2].

List of Useful Formulae for CE 411

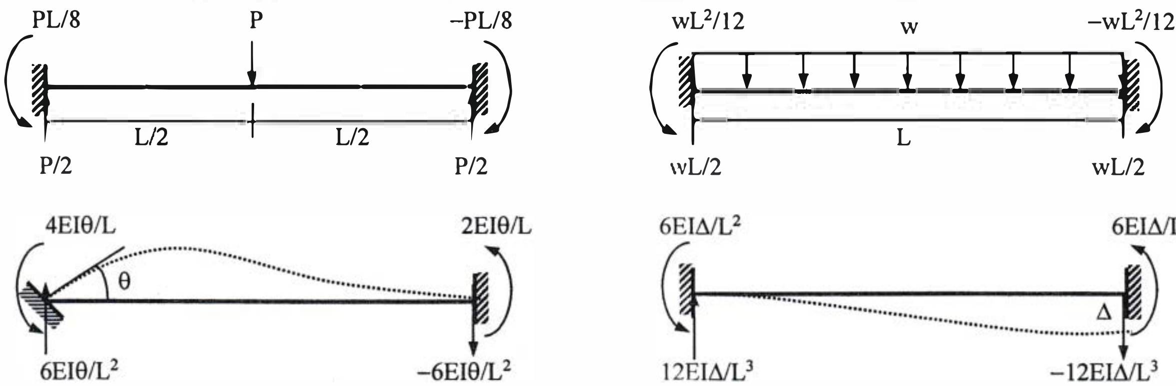
* The stiffness matrix $\mathbf{K_m}^G$ of a 2D truss member in the global axis system is given by

$$\mathbf{K_m}^G = S_x \begin{pmatrix} C^2 & CS & -C^2 & -CS \\ CS & S^2 & -CS & -S^2 \\ -C^2 & -CS & C^2 & CS \\ -CS & -S^2 & CS & S^2 \end{pmatrix}$$

and Truss member force, $P_{AB} = S_x\,[(u_B - u_A)\,C + (v_B - v_A)\,S]$

[where $C = \cos\theta$, $S = \sin\theta$]

<u>Fixed End Reactions for One-dimensional Prismatic Members under Typical Loadings</u>



* The stiffness matrix of a 3D truss member in the global axes system [using $C_x = \cos\alpha$, $C_y = \cos\beta$, $C_z = \cos\gamma$] is

$$\mathbf{K_m}^G = S_x \begin{pmatrix} C_x^2 & C_xC_y & C_xC_z & -C_x^2 & -C_xC_y & -C_xC_z \\ C_yC_x & C_y^2 & C_yC_z & -C_yC_x & -C_y^2 & -C_yC_z \\ C_zC_x & C_zC_y & C_z^2 & -C_zC_x & -C_zC_y & -C_z^2 \\ -C_x^2 & -C_xC_y & -C_xC_z & C_x^2 & C_xC_y & C_xC_z \\ -C_yC_x & -C_y^2 & -C_yC_z & C_yC_x & C_y^2 & C_yC_z \\ -C_zC_x & -C_zC_y & -C_z^2 & C_zC_x & C_zC_y & C_z^2 \end{pmatrix}$$

$C_x = L_x/L$, $C_y = L_y/L$, $C_z = L_z/L$
where $L = \sqrt{[L_x^2 + L_y^2 + L_z^2]}$

* Member force $P_{AB} = S_x\,[(u_B - u_A)\,C_x + (v_B - v_A)\,C_y + (w_B - w_A)\,C_z]$

* Ignoring axial deformations, the matrices $\mathbf{K_m}^L$ and $\mathbf{G_m}^L$ of a frame member in the local axis system are

$$\mathbf{K_m}^L = \begin{pmatrix} S_1 & S_2 & -S_1 & S_2 \\ S_2 & S_3 & -S_2 & S_4 \\ -S_1 & -S_2 & S_1 & -S_2 \\ S_2 & S_4 & -S_2 & S_3 \end{pmatrix} \qquad \mathbf{G_m}^L = (P/30L)\begin{pmatrix} 36 & 3L & -36 & 3L \\ 3L & 4L^2 & -3L & -L^2 \\ -36 & -3L & 36 & -3L \\ 3L & -L^2 & -3L & 4L^2 \end{pmatrix}$$

where $S_1 = 12EI/L^3$, $S_2 = 6EI/L^2$, $S_3 = 4EI/L$, $S_4 = 2EI/L$

*The general form of the stiffness matrix for any member of a 2-dimensional frame is

$$\mathbf{K_m}^G = \begin{pmatrix} S_xC^2+S_1S^2 & (S_x-S_1)CS & -S_2S & -(S_xC^2+S_1S^2) & -(S_x-S_1)CS & -S_2S \\ (S_x-S_1)CS & S_xS^2+S_1C^2 & S_2C & -(S_x-S_1)CS & -(S_xS^2+S_1C^2) & S_2C \\ S_2S & S_2C & S_3 & S_2S & -S_2C & S_4 \\ -(S_xC^2+S_1S^2) & -(S_x-S_1)CS & S_2S & S_xC^2+S_1S^2 & (S_x-S_1)CS & S_2S \\ -(S_x-S_1)CS & -(S_xS^2+S_1C^2) & -S_2C & (S_x-S_1)CS & (S_xS^2+S_1C^2) & -S_2C \\ -S_2S & S_2C & S_4 & S_2S & -S_2C & S_3 \end{pmatrix}$$

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2019
Program: B.Sc. Engineering (Civil)

Course Title: Geotechnical Engineering II — Course Code: CE 441
Time: 1 hour — Full Marks: 20

Answer all the questions. **(5*4 = 20)**

1. During standard penetration tests (Figure 1), at 5 m below ground level, N_{60} was obtained after applying the corrections for borehole diameter, hammer efficiency, rod length and sampler, as below:
   $N_{60} = 10.4$
   (i) Calculate $(N_1)_{60}$. 1.5
   (ii) Compare the effective angle of internal friction (at the depth of 5 m) estimated based on both N_{60} and $(N_1)_{60}$. 1.5

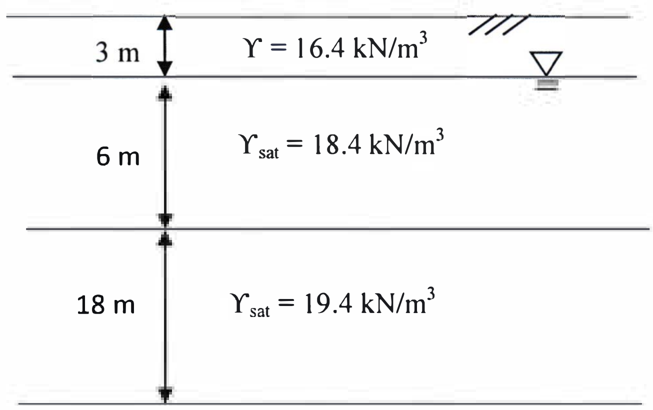


Figure 1

2. During a field vane shear test, at a given depth
   Maximum torque applied = 1450 kg-cm
   Soil properties: LL = 48%, PL = 29%
   Vane Constant, K= 0.00056

   Calculate the undrained shear strength of the clay soil in field condition for design purpose? 1

3. For the individual shallow footing (Figure 2), calculate the net allowable bearing capacity for the following cases:

(a) if eccentricity along footing width is 0.25 m. The load is vertical. 3

(b) if the load is vertical. And just at the center of the footing base. 3

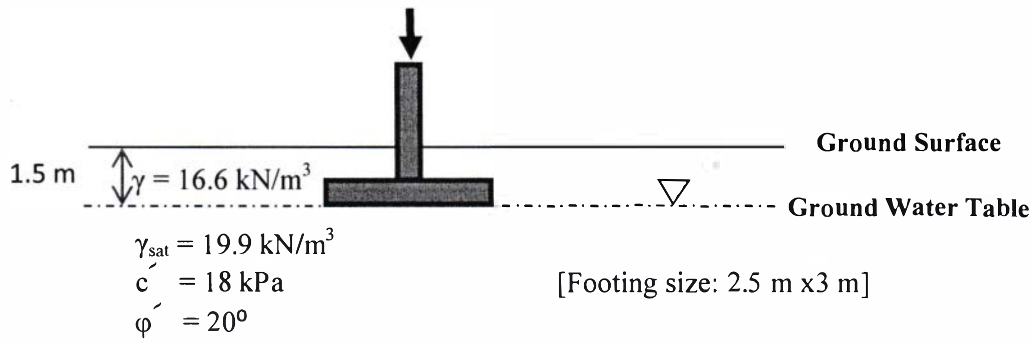


Figure 2

4. Calculate the gross ultimate bearing capacity of a 2.5 m wide strip footing in the soil profile given in Figure 3. 3

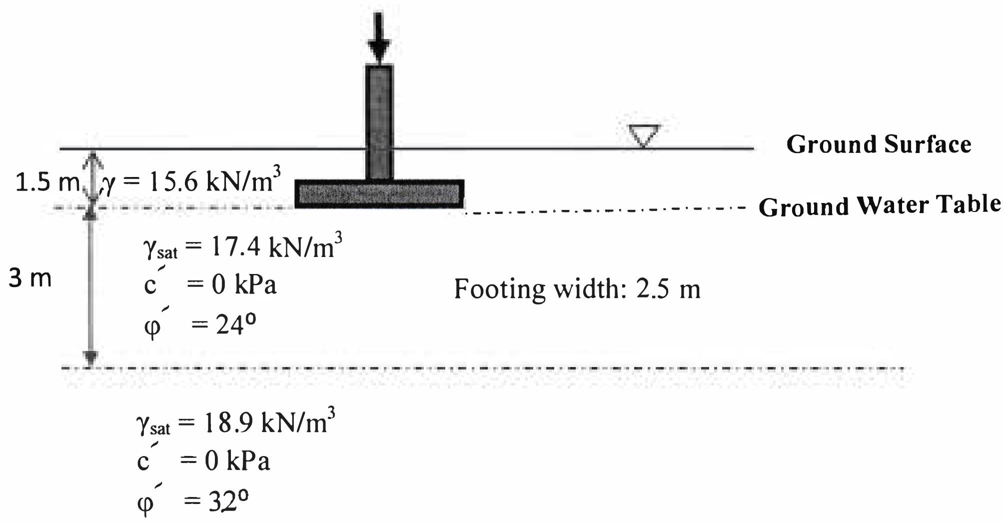


Figure 3

5. Calculate the following for Figure 4. Use FS = 3. No of pile (concrete) in the group = 12
   (a) Allowable capacity of an individual pile. 5
   (b) Allowable capacity of a pile in the group. Use efficiency factor according to Converse-Labarre formula 1
   (c) Allowable capacity of the pile group. 1

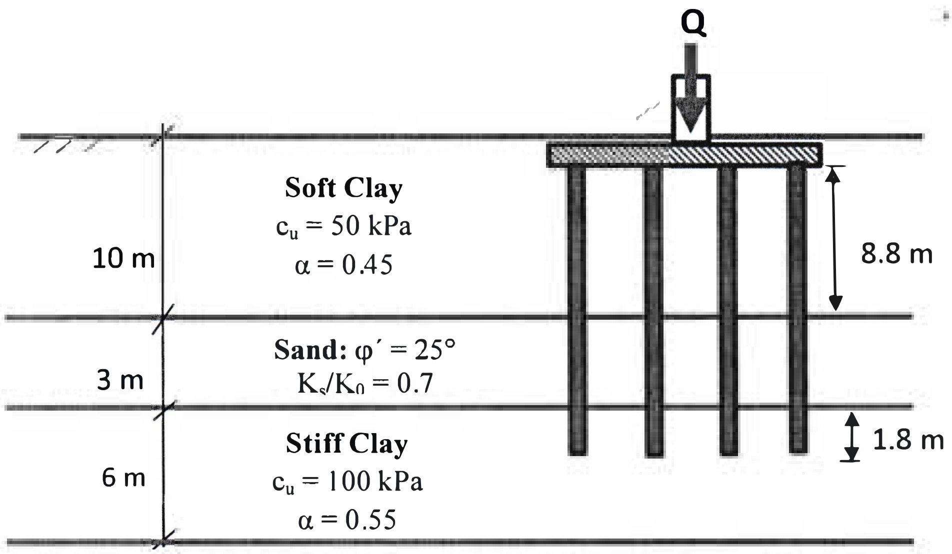


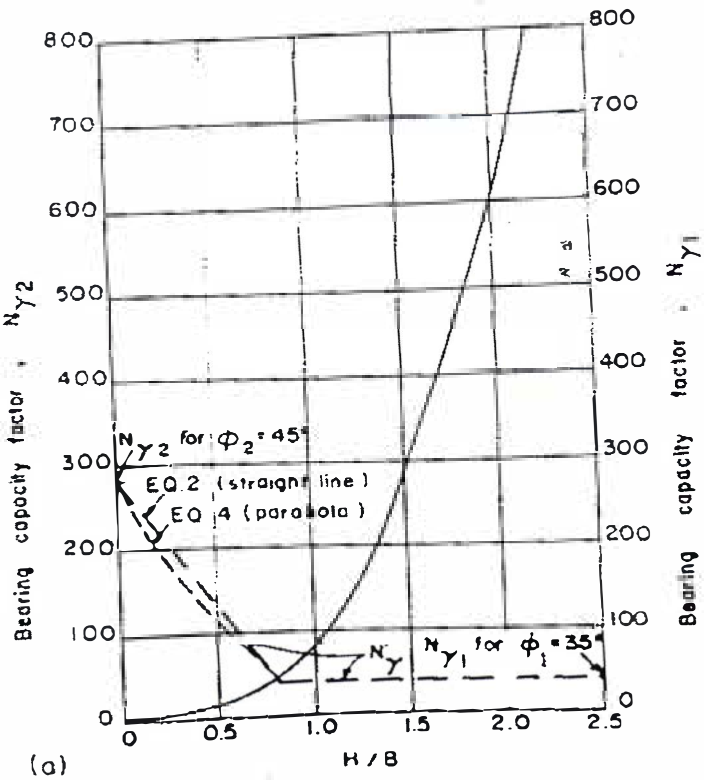
Figure 4

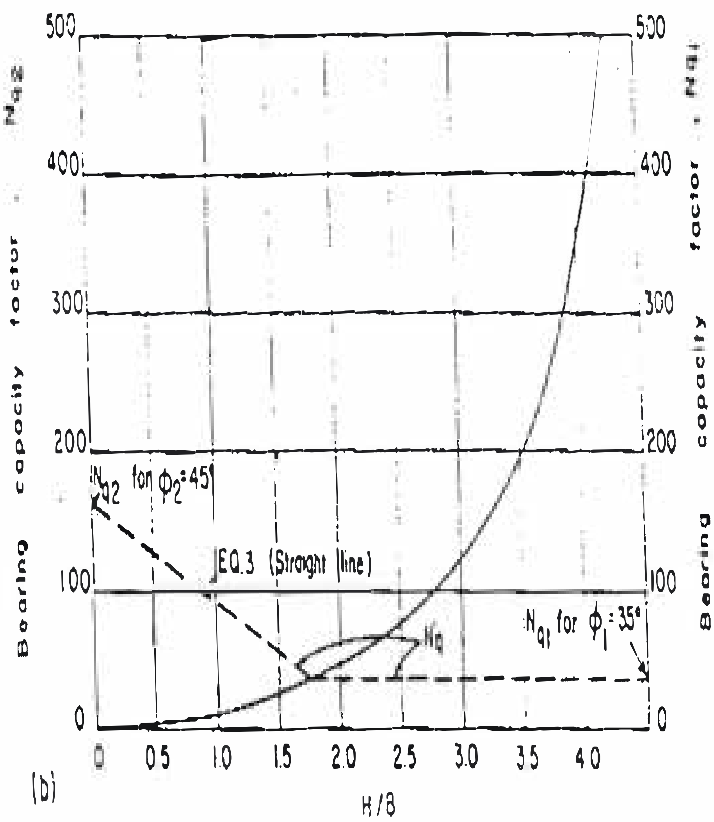
Important Correlations

$$\varphi' = tan^{-1}\left[\frac{N_{60}}{12.2 + 20.3\left(\frac{\sigma'_0}{P_a}\right)}\right]^{0.34}$$

$$\varphi' = \sqrt{20(N_1)_{60} + 20}$$

$$\lambda = 1.7 - 0.54\, log[PI(\%)]$$





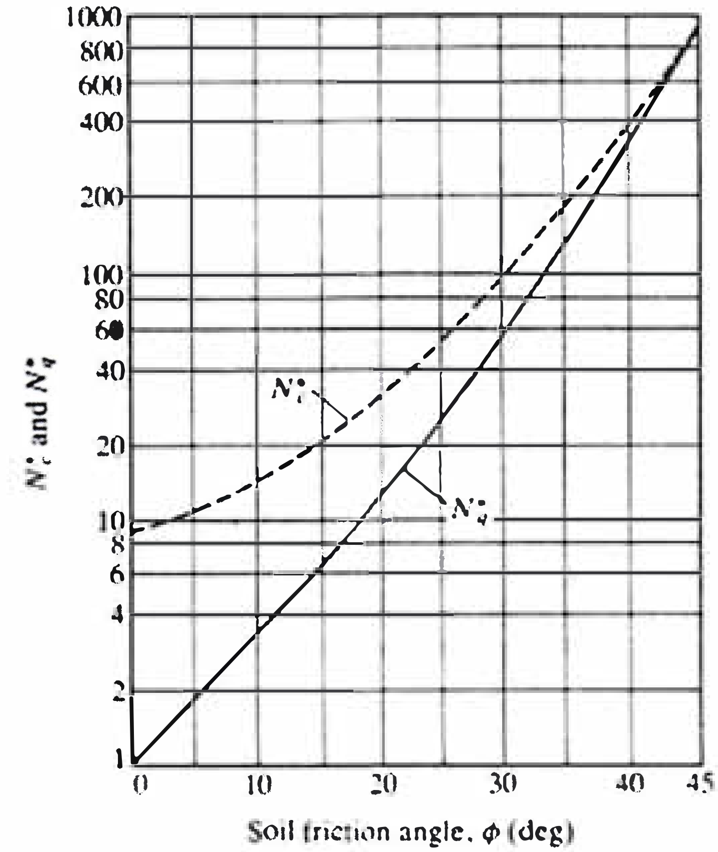
Design Charts: Weak sand overlying strong sand

Table 1: Bearing Capacity Factors for General Bearing Capacity Equation

ϕ	N_c	N_q	N_γ (Meyerhof)	ϕ	N_c	N_q	N_γ (Meyerhof)	ϕ	N_c	N_q	N_γ (Meyerhof)
0°	5.10	1.00	0.00	17°	12.34	4.77	1.66	34°	42.16	29.44	31.15
1°	5.38	1.09	0.00	18°	13.10	5.26	2.00	35°	46.12	33.30	37.15
2°	5.63	1.20	0.01	19°	13.93	5.80	2.40	36°	50.59	37.75	44.43
3°	5.90	1.31	0.02	20°	14.83	6.40	2.87	37°	55.63	42.92	53.27
4°	6.19	1.43	0.04	21°	15.81	7.07	3.42	38°	61.35	48.93	64.07
5°	6.49	1.57	0.07	22°	16.88	7.82	4.07	39°	67.87	55.96	77.33
6°	6.81	1.72	0.11	23°	18.05	8.66	4.82	40°	75.31	64.20	93.69
7°	7.16	1.88	0.15	24°	19.32	9.60	5.72	41°	83.86	73.90	113.99
8°	7.53	2.06	0.21	25°	20.72	10.66	6.77	42°	93.71	85.37	139.32
9°	7.92	2.25	0.28	26°	22.25	11.85	8.00	43°	105.11	99.01	171.14
10°	8.34	2.47	0.37	27°	23.94	13.20	9.46	44°	118.37	115.31	211.41
11°	8.80	2.71	0.47	28°	25.80	14.72	11.19	45°	133.87	134.87	262.74
12°	9.28	2.97	0.60	29°	27.86	16.44	13.24	46°	152.10	158.50	328.73
13°	9.81	3.26	0.74	30°	30.14	18.40	15.67	47°	173.64	187.21	414.33
14°	10.37	3.59	0.92	31°	32.67	20.63	18.56	48°	199.26	222.30	526.46
15°	10.98	3.94	1.13	32°	35.49	23.18	22.02	49°	229.93	265.50	674.92
16°	11.63	4.34	1.37	33°	38.64	26.09	26.17				

Table 2: Shape, Depth & Load Inclination Factors for General Bearing Capacity Equation

Author	Factor	Condition	Equation
Meyerhof	Shape	$\phi = 0°$	$F_{cs} = 1 + 0.2\left(\frac{B}{L}\right)$ $F_{qs} = F_{\gamma s} = 1$
		$\phi \geq 10°$	$F_{cs} = 1 + 0.2\left(\frac{B}{L}\right)\tan^2\left(45 + \frac{\phi}{2}\right)$ $F_{qs} = F_{\gamma s} = 1 + 0.1\left(\frac{B}{L}\right)\tan^2\left(45 + \frac{\phi}{2}\right)$
	Depth	$\phi = 0°$	$F_{cd} = 1 + 0.2\left(\frac{D_f}{B}\right)$ $F_{qd} = F_{\gamma d} = 1$
		$\phi \geq 10°$	$F_{cd} = 1 + 0.2\left(\frac{D_f}{B}\right)\tan\left(45 + \frac{\phi}{2}\right)$ $F_{qd} = F_{\gamma d} = 1 + 0.1\left(\frac{D_f}{B}\right)\tan\left(45 + \frac{\phi}{2}\right)$



Coefficient of friction between sand and pile material	tan δ
Concrete	0.45
Wood	0.40
Steel (smooth)	0.20
Steel (rough, rusted)	0.4
Steel (corrugated)	Use tan Φ of sand

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2019
Program: B. Sc. Engineering (Civil)

Course Title: Transportation Engineering II — Course Code: CE 451
Time: 1 hour — Full Marks: 30

[Assume Reasonable Values for Any Missing Data]

Answer all questions

1. a. The gradation required for a typical mix is given in Table 1 in column 1 and 2. The gradation of available aggregates A, B, and C are given in column 3, 4, and 5. **Determine the proportions of A, B and C if mixed will get the required gradation in column 2.** 10

Table 1

Sieve Size (mm) (1)	Required Gradation Range (2)	Filler (A) (3)	Fine Aggregate (B) (4)	Coarse Aggregate (C) (5)
25.4	100.0	100.0	100.0	100.0
12.7	90.0-100.0	100.0	100.0	94.0
4.76	60.0-75.0	100.0	100.0	54.0
1.18	40.0-55.0	100.0	66.4	31.3
0.3	20.0-35.0	100.0	26.0	22.8
0.15	12.0-22.0	73.6	17.6	9.0
0.075	5.0-10.0	40.1	5.0	3.1

b. **Design an asphalt concrete mixture** for a highway pavement to support medium traffic. Use the aggregate characteristics obtained from previous question (1(a). Table 2 showing data obtained using the Marshall method were used. Determine the optimum asphalt content for this mix for the specified limits given in Table 3. (The nominal maximum particle size in the aggregate mixture is 1 in.) 20

Table 2 Marshall Test Result

Asphalt % by Weight of Total Mix	Weight of Specimen (g) in air	Weight of Specimen (g) in water	Stability (lb)	Flow (0.01 in)	Maximum Specific Gravity of Paving Mixture
5.0	1400	780	1500	7	2.54
5.5	1350	790	1600	10	2.56
6.0	1331	800	1600	11	2.58
6.5	1343	800	1450	13	2.56
7.0	1349	788	1300	13	2.54

Table 3 Suggested Test Limit

Marshall Method Mix Criteria	Light Traffic	Medium Traffic	Heavy Traffic
Compaction (No. of blows each end of Specimen)	35	50	75
Stability N (lb)	3336(750)	5338(1200)	8006(1800)
Flow 0.25 mm (0.01 in)	8 to 18	8 to 16	8 to 14
Air Voids (%)	3 to 5	3 to 5	3 to 5
Mineral Percentage of Voids in Mineral Aggregates			
Standard Sieve Designation	%		
No. 16	23.5		
No. 4	21		
No. 8	18		
3/8 in.	16		
½ in.	15		
¾ in.	14		
1 in.	13		
1 ½ in.	12		
2 in.	11.5		
2 ½ in.	11		

Required Formula:

$$G_{mb} = \frac{W_a}{W_a - W_w}$$

$$P_a = 100\frac{G_{mm} - G_{mb}}{G_{mm}}$$

$$G_{sb} = \frac{P_{ca} + P_{fa} + P_{mf}}{\frac{P_{ca}}{G_{bca}} + \frac{P_{fa}}{G_{bfa}} + \frac{P_{mf}}{G_{bmf}}}$$

$$G_{se} = \frac{100 - P_b}{(100/G_{mm}) - (P_b/G_b)}$$

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Spring 2019
Program: B.Sc. Engineering (Civil)

Course code: CE 461
Course title: Irrigation and Flood Control

Time: 60 Minutes | Total marks: 20

Answer all questions

1. Explain why irrigation is important for Bangladesh. **(2)**
2. Do you agree that in Bangladesh *sprinkler irrigation method is* more appropriate than *furrow irrigation method*? Justify your answer. **(3.5)**
3. Bangladesh is the most downstream country of three major rivers basins in South Asia, namely, Ganges, Brahmaputra and Meghna. As a result, during monsoon period, Bangladesh is affected by flood regularly. In the 1980s and 1990s, Bangladesh put heavy emphasis on flood control and built embankments across the country. However, over the last two decades, relevant water professionals and scholars are recognizing that flood cannot be controlled rather emphasis should be given to sustainable management of flood.

   Do you agree with the above statement that flood in Bangladesh cannot be controlled? Justify your answer. **(4.5)**
4. Determine the time required to irrigate a strip of land containing clay loam soil from a tube-well with a discharge of 0.14 m^3/s by using border flooding method. The infiltration capacity of the soil may be taken as 6 cm/h and the average depth of flow on the field as 15 cm. **(2.5)**
5. A European automobile manufacturer is planning to open a new *automobile assembly plant* in Bangladesh. Exports Promotion Bureau of Bangladesh offered them two lands, one in *Norshingdi* and one is *Netrokona*, from which the company management has to choose one location for their *automobile assembly plant*.

   Based on your knowledge about geological condition and flood hazards risk, which district (Norshingdi or Netrokona) the company should select for its new plant? Justify your answer. **(3)**
6. Explain the following: i) Integrated water resources management, ii) Soil moisture tension; iii) Conjunctive use of water. **(3*1.5 = 4.5)**