Course No: CVL 2402
Course Title: Foundation Engineering
Date: 29/11/2015
No. of Questions: (3)
Time: 1 hr
Using Calculator (Yes)

University of Palestine

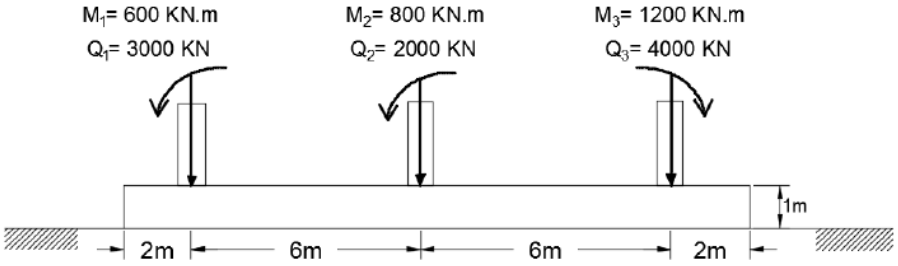
Second Midterm Exam
First semester
2016/2017
Total Grade: 15

Instructor Name: Dr. Sari Abusharar
Student No.: _____
Student Name: _____
College Name: Engineering
Dep. / Specialist: Civil Engineering
Using Dictionary (No)

Answer All Questions

First Question 5/15

Determine B_1 and B_2 of a trapezoidal footing for a uniform soil pressure of 300 kN/m^2. (Consider the weight of the footing, given that $\gamma_{concrete}$ = 24 KN/m^3).



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Second Question **5/15**

For a rectangular foundation constructed on loose layered saturated clay, given:

- B = 1.22 m, L =1.83 m, H = 0.61 m, D_f = 0.91 m
- γ_1 = 17.29 kN/m^3, ϕ'_1= 0, c'_1= 57.5 kN/m^2
- γ_2 = 19.65 kN/m^3, ϕ'_2= 0, c'_2= 119.79 kN/m^2

Using a factor of safety of 4, determine the gross allowable load the foundation can carry.

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Using Dictionary (No)

Third Question **5/15**

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Course Title: Foundation Engineering
Date: 29/11/2015
No. of Questions: (3)
Time: 1 hr
Using Calculator (Yes)

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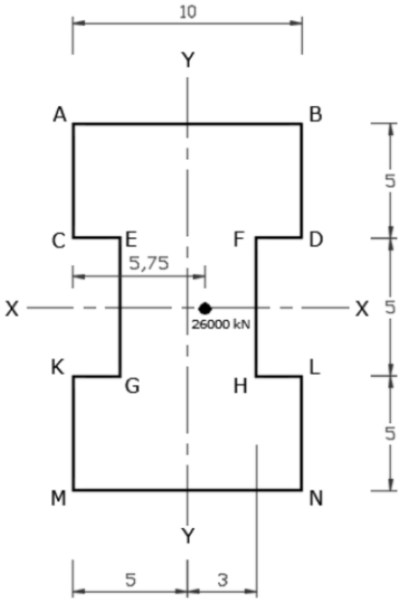
Using Dictionary (No)

Calculate the base pressure at the points: A, D, F, G and M indicated below the mat foundation as shown in the below figure. Total vertical load acting on the foundation is 26000 kN and its location is shown in the figure.



(All dimensions are in meters)

End of Questions
Good Luck

Useful Formulae

$$q_u = q_t + (q_b - q_t)\left(\frac{H}{D}\right)^2 \geq q_t$$

$$q_t = c_1 N_{c(1)} F_{cs(1)} + \gamma_1 D_f N_{q(1)} F_{qs(1)} + \frac{1}{2}\gamma_1 B N_{\gamma(1)} F_{\gamma s(1)}$$

$$q_b = c_2 N_{c(2)} F_{cs(2)} + \gamma_2 D_f N_{q(2)} F_{qs(2)} + \frac{1}{2}\gamma_2 B N_{\gamma(2)} F_{\gamma s(2)}$$

$D \approx B$ for loose sand and clay
$D \approx 2B$ for dense sand

For a trapezoid, $\overline{x} = \left(\frac{B_1+2B_2}{B_1+B_2}\right)\frac{L}{3}$

$$q = \frac{Q}{A} \pm \frac{M_y x}{I_y} \pm \frac{M_x y}{I_x}$$

Table 3.3 Bearing Capacity Factors

ϕ'	N_c	N_q	N_γ	ϕ'	N_c	N_q	N_γ
0	5.14	1.00	0.00	26	22.25	11.85	12.54
1	5.38	1.09	0.07	27	23.94	13.20	14.47
2	5.63	1.20	0.15	28	25.80	14.72	16.72
3	5.90	1.31	0.24	29	27.86	16.44	19.34
4	6.19	1.43	0.34	30	30.14	18.40	22.40
5	6.49	1.57	0.45	31	32.67	20.63	25.99
6	6.81	1.72	0.57	32	35.49	23.18	30.22
7	7.16	1.88	0.71	33	38.64	26.09	35.19
8	7.53	2.06	0.86	34	42.16	29.44	41.06
9	7.92	2.25	1.03	35	46.12	33.30	48.03
10	8.35	2.47	1.22	36	50.59	37.75	56.31

Table 3.4 Shape, Depth and Inclination Factors (DeBeer (1970); Hansen (1970); Meyerhof (1963); Meyerhof and Hanna (1981))

Factor	Relationship	Reference
Shape	$F_{cs} = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right)$ $F_{qs} = 1 + \left(\frac{B}{L}\right)\tan\phi'$ $F_{\gamma s} = 1 - 0.4\left(\frac{B}{L}\right)$	DeBeer (1970)