



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FOURTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 403 FOUNDATION ENGINEERING 1

DATE: 26/7/2019

TIME: 2.00-4.00 PM

INSTRUCTIONS: Answer questions **ONE** and any other **TWO** questions.

QUESTION ONE (30 MARKS)

- a) Briefly explain how the following factors affects the magnitude and line of action of the lateral pressure. (6 marks)
- Mode of movement of the wall
 - Flexibility of the wall
 - Properties of soils
 - Drainage conditions
- b) Briefly discuss the effect of water table on the bearing capacity of the soil. (2 marks)
- c) Discuss three types of shear failures. (6 marks)
- d) Briefly discuss three types of foundation settlements under loads. (6 marks)
- e) A footing 2 m square is laid at a depth of 1.3 m below the group surface. Take $\gamma = 20 \text{ kN/m}^3$, $\phi' = 30^\circ$ and $c = 15 \text{ kN/m}^2$. Assume local shear failure. Determine the net ultimate bearing capacity when
- The water table is far below the base (4 marks)
 - The water table rises to the level of the base (2 marks)

- iii. The water table rises to the ground surface (2 marks)
- iv. The water is 1 m below the base (2 marks)

QUESTION 2 (20 MARKS)

A retaining wall of a vertical back and height of 7.32 m is used to retain sandy loam soil of with the following parameters, $\gamma = 12 \text{ kN/m}^3$, $\phi = 20^\circ$. Neglecting wall friction and taking the upper surface of the fill to be horizontal.

- a) Determine the active thrust of the wall. Also, determine the location of the thrust. (8 marks)
- b) If the drains are blocked and water table rises to a height of 2.75m from the bottom of the wall, determine the active thrust of the wall. Also, determine the location of the thrust.

(12 marks)

QUESTION 3 (20 MARKS)

A 30 cm diameter pile of length 12 m was subjected to a pile load test and the following results were obtained. Determine the allowable load if

Allowable settlement is 10% pile diameter

Load (kN)	0	500	1000	1500	2000	2500
Settlement during a loading (cm)	0	0.5	1.1	1.9	3.2	7.1
Settlement during a unloading (cm)	5.6	6	6.5	6.7	6.9	7.1

QUESTION 4 (20 MARKS)

Consider a square footing foundation of 2m x 2m plan at depth of 2m in a sand deposit, as shown in the Figure 1 below.

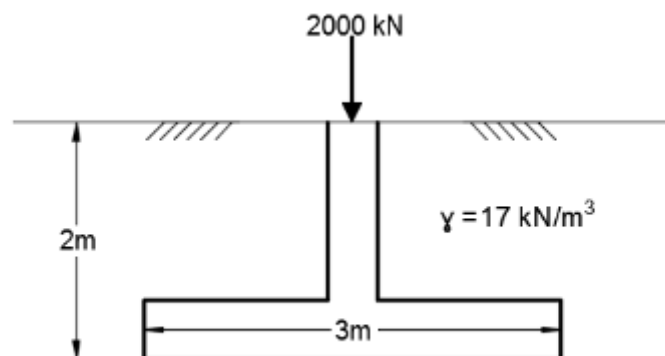


Figure 1

Calculate the elastic settlement of the footing after 6 years of construction using strain influence factor method given the cone penetration test values in the table below.

Depth (m) from the ground surface	$q_c(\text{kN/m}^2)$
0-2	8000
2-4	10000
4-6	9000
6-8	8500

Calculate the net allowable bearing capacity, If the corrected standard penetration number = 10 and the allowable settlement is 25.4mm.

TABLE 20.1: Rectangular Bearing Capacity Factors

ϕ'	General Shear Failure			Local Shear Failure			N_q' (Vesic)
	N_c	N_q	N_γ	N_c'	N_q'	N_γ'	
0	5.7	1.0	0.0	5.7	1.0	0.0	1.0
5	7.3	1.6	0.5	6.7	1.4	0.2	1.2
10	9.6	2.7	1.2	8.0	1.9	0.5	1.6
15	12.9	4.4	2.5	9.7	2.7	0.9	2.2
20	17.7	7.4	5.0	11.8	3.9	1.7	3.3
25	25.1	12.7	9.7	14.8	5.6	3.2	5.3
30	37.2	22.5	19.7	19.0	8.3	5.7	9.5
35	57.8	41.4	42.4	25.2	12.6	10.1	18.7
40	95.7	81.3	100.4	34.9	20.5	18.8	42.5
45	172.3	173.3	297.5	51.2	35.1	37.7	115.0
50	347.5	415.1	1153.2	81.3	65.6	87.1	329.10