Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	FOUNDATION ENGINEERING
COURSE CODE	:	BFC 43103
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTIONS	:	1.ANSWER ALL QUESTIONS. 2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.** 3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

Q1 (a) Explain with relevant sketches any **ONE (1)** type of shallow foundation that is suitable to minimize the problem associated with differentiate settlement of foundation and its working principles.

(6 marks)

(b) Failure occur in shallow foundation as the effect of increased load can be categorized as general shear failure, local shear failure and punching shear failure Hypothesize the failure mode of shallow foundation constructed on well compacted ground.

(4 marks)

(c) A typical square pad footing as shown in **Figure Q1** is proposed.

(i) Determine the bearing capacity of this square pad footing using Terzaghi's method.

(6 marks)

(ii) It was reported that the water table will fluctuate in between 0.5 m, 1.5 m and 4 m from ground surface throughout the year. Explain the depth of water level that may causing pad footing to be most critical. The explanation must be supported by the relevant calculations.

(9 marks)

Q2 (a) Describe the following:

(i) Friction pile
(ii) Bearing capacity of pile resting on rock
(iii) Large displacement pile

(9 marks)

(b) For a group pile, the piles may act as a block and individual piles. The ratio of bearing capacity of block piles and individual piles are known as group efficiency. Investigate the importance of group efficiency in a pile group design with suitable illustration and explanations.

(7 marks)

(c) A circular pile having a diameter of 400 mm are embedded in clay. The length of the piles is 8 m. The dry unit weight of the clay is 18 kN/m^3. The water table is located at a depth of 2 m and the saturated unit weight of the clay is 20 kN/m^3. The recorded undrained shear strength (C_u) profile for the ground is shown in **Table Q2**. Evaluate the allowable load bearing capacity of the pile with a factor safety of (FS) of 2.5 by using α method.

(9 marks)

Q3 (a) In construction technology, a retaining wall could be a significant reasonable construction. The first function of the wall is to keep the earth or other materials vertical or near-vertical. This wall is commonly used in various applications, including road, railway, bridge, irrigation engineering, land reclamation, and coastal engineering. However, there are a few failure types of retaining wall that commonly occur. Describe any **THREE (3)** types of retaining wall failure with sketches.

(6 marks)

(b) The BUMI consultant had proposed a retaining wall with dimensions and soil properties as shown in **Figure Q3**. Given: unit weight of concrete = 24.0 kN/m^3, $\delta' = 2/3\phi'$, and $c_a' = 2/3c'$. Check the stability of retaining wall with respect to

(i) overturning

(9 marks)

(ii) sliding, and

(6 marks)

(iii) bearing capacity failure.

(4 marks)

Q4 (a) A new federal road is proposed to link Kluang and Batu Pahat in order to bypass the high congestion area. Based on the preliminary desk study, the newly proposed link road will pass by a swampy area which comprised of peat and marine deposits.

(i) As the chief designer of JKR, you are requested to propose a ground improvement scheme that needs to be carried out in advance before the commencement of the road construction project. The proposal should highlight the working principles of the proposed ground improvement methods and be supported by relevant sketches.

(8 marks)

(ii) Predict any **ONE (1)** foreseen problem if the ground improvement scheme is not carried out before the commencement of the road construction project.

(2 marks)

(b) Cement stabilization is one of the popular solutions to improve the bearing capacity of soft soils. Briefly discuss any **TWO (2)** advantages and **TWO (2)** disadvantages compared to the mechanical stabilization method using roller.

(8 marks)

(c) Evaluate whether dynamic compaction using tamper is suitable in areas comprised of quaternary marine deposits.

(7 marks)

- END OF QUESTIONS -

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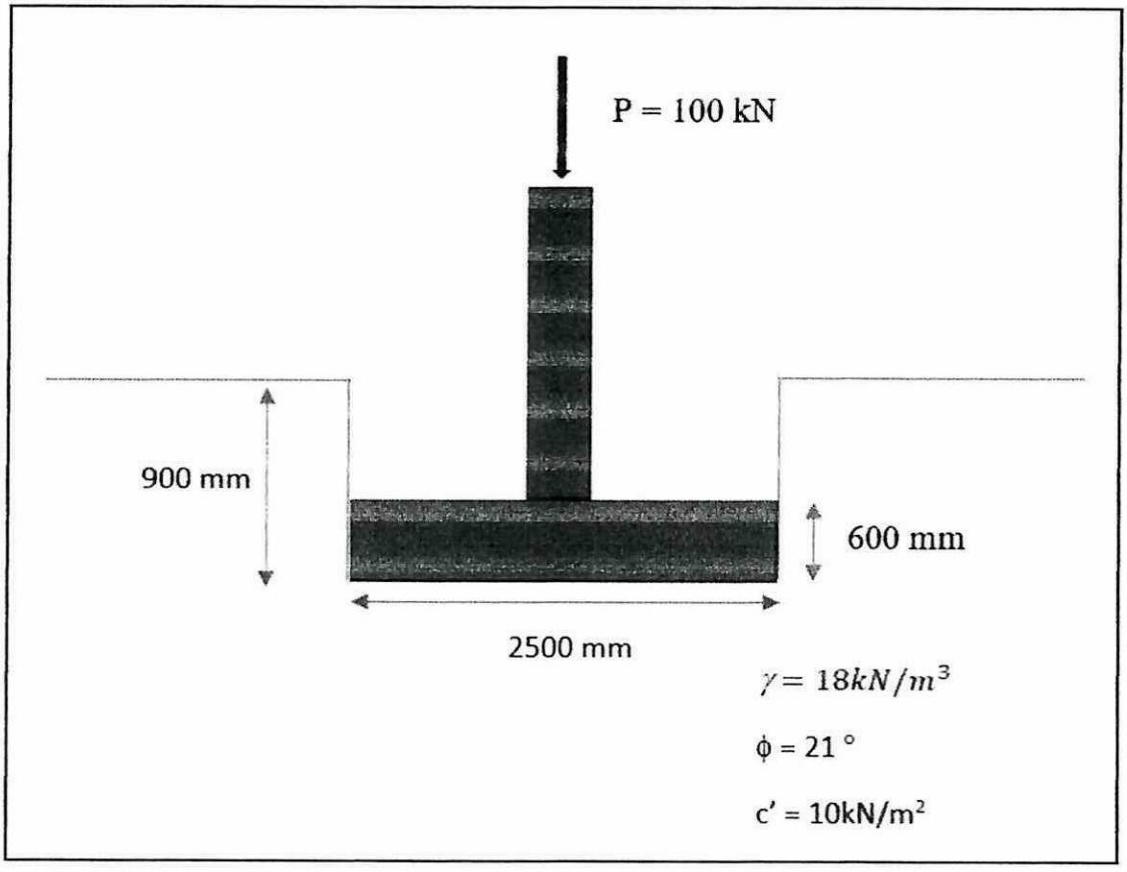

Figure Q1: Pad footing

Table Q2: Variation of C_u with pile embedment length

Depth (m)	0 - 4	4 - 7	7 - 13
Undrained shear strength, C_u (kN/m^2)	70	85	100

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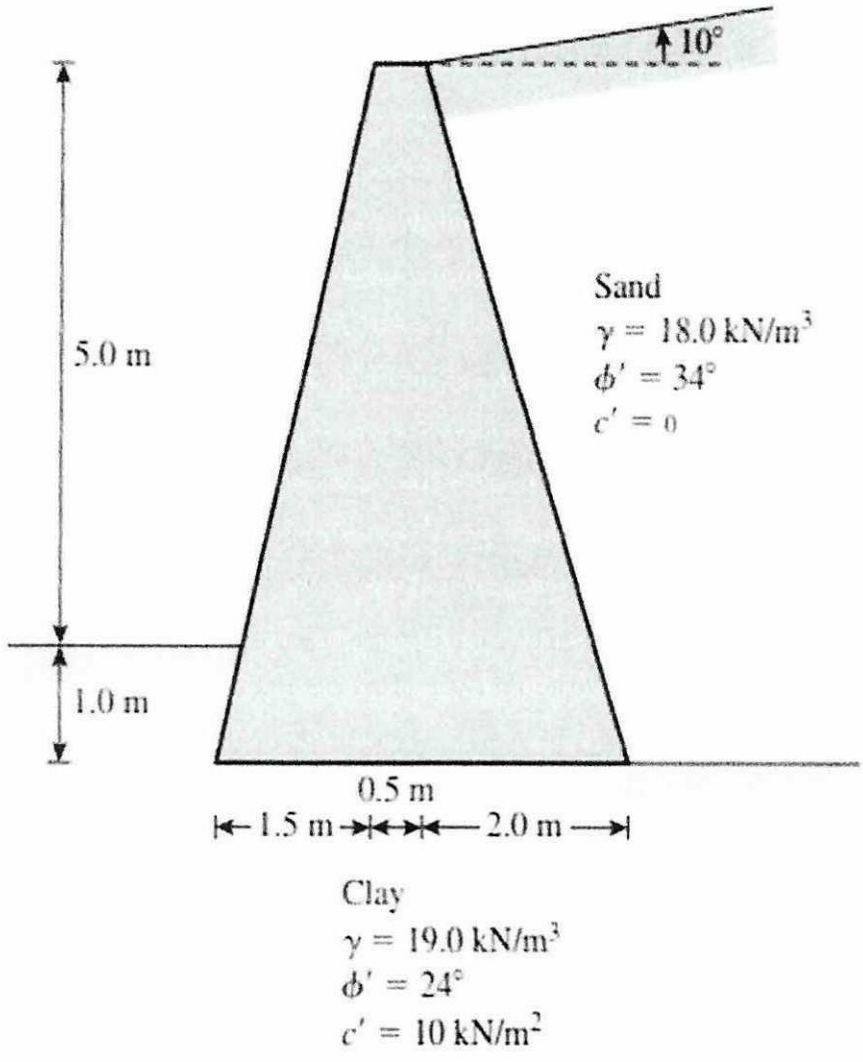

Figure Q3: Gravity retaining wall

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Appendix A: Design Tables and Charts

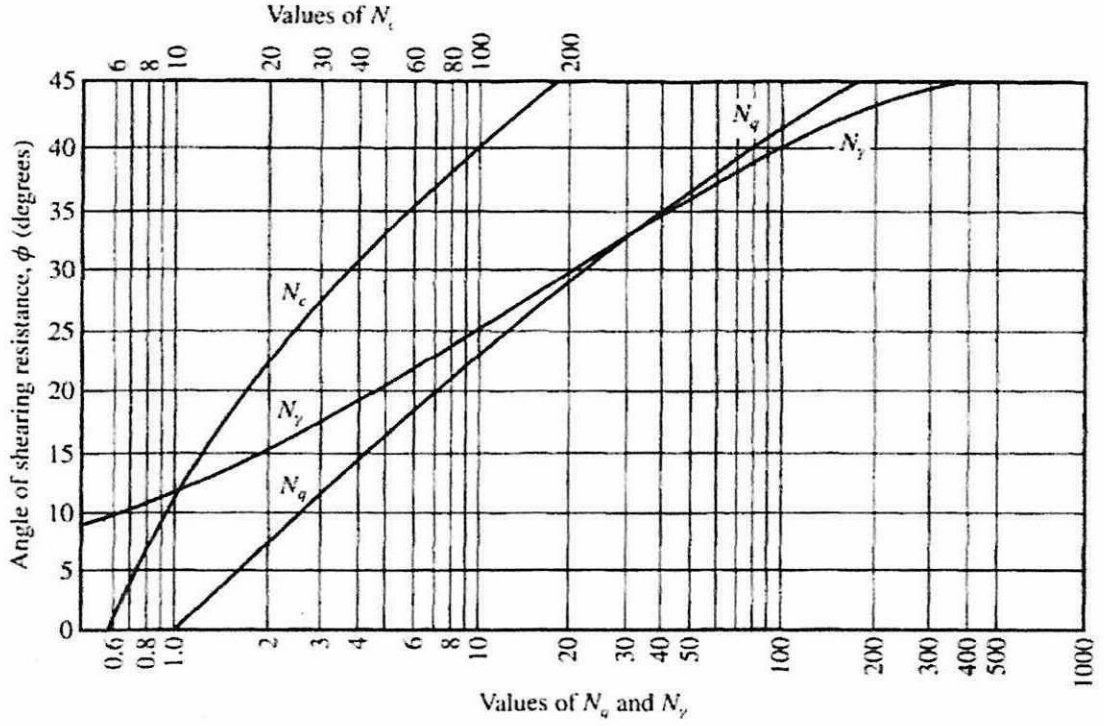

Figure I: Terzaghi's bearing capacity factors

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Table I: Variation of α

$\frac{c_u}{p_a}$	α
≤ 0.1	1.00
0.2	0.92
0.3	0.82
0.4	0.74
0.6	0.62
0.8	0.54
1.0	0.48
1.2	0.42
1.4	0.40
1.6	0.38
1.8	0.36
2.0	0.35
2.4	0.34
2.8	0.34

Note: p_a = atmospheric pressure ≈ 100 kN/m^2 or 2000 lb/ft^2

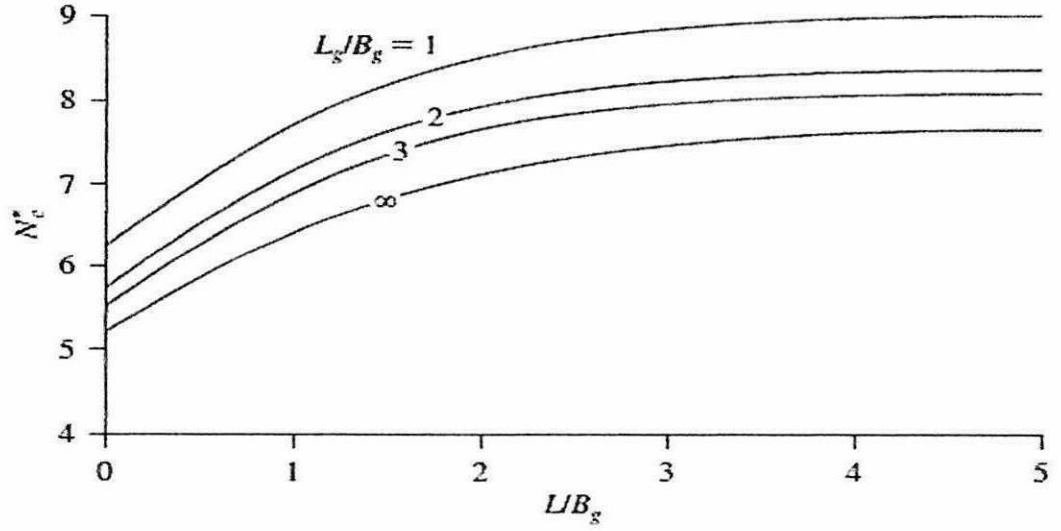

Figure II: Variation of N_c with L/B_g

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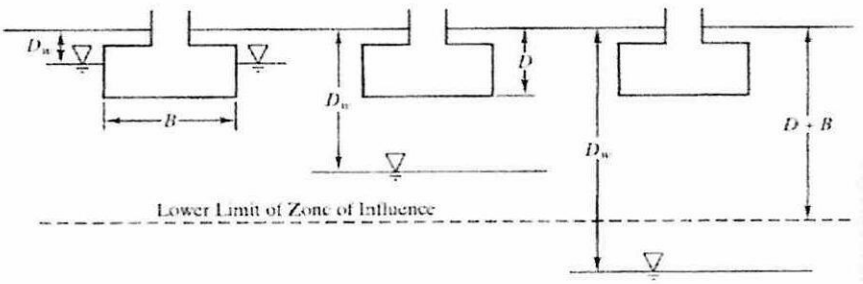
Appendix B: Formulas

These formulas may be useful to you. The symbols have their usual meaning.

$$q_u = cNc + qNq + 0.5\gamma BN_\gamma$$

$$q_u = 1.3cNc + qNq + 0.4\gamma BN_\gamma$$

$$q_u = 1.3cNc + qNq + 0.3\gamma BN_\gamma$$



Case 1: $D_w \leq D$, Hence $\gamma' = \gamma_b = \gamma - \gamma_w$

Case 2: $D < D_w \leq (D + B)$, Hence

$$\gamma' = \gamma - \gamma_w \left(1 - \left(\frac{D_w - D}{B}\right)\right)$$

Case 3: $(D + B) \leq D_w$, Hence $\gamma' = \gamma$