TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2406 FOUNDATION ENGINEERING 1

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS

Instructions to Candidates
You should have the following for this examination
-*Answer Booklet, examination pass and student ID*
This paper consists of five questions.
Attempt question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

QUESTION ONE (COMPULSORY) 30 Marks

a) Draw a neat sketch of a Mohr circle for a cohesionless soil behind a vertical smooth retaining wall. From your sketch:-
   i. Explain what points on the Mohr circle that represent the lateral pressure and the vertical pressure for the soil at various depths.
   ii. Derive the relationship of the vertical pressure and the lateral pressure

[7Marks] a)

b) A retaining wall 7.5 metres high retains a cohesionless back fill. The top three metres of the fill has a unit weight (γ) of $18kN/m^3$ and an angle of internal friction (φ) of 35^o. The rest of the fill has a unit weight $24kN/m^3$ and angle of internal friction equal to 20^o and C = $10kN/m^2$. Determine the total thrust on the wall and its point of action.

[13Marks]

ANSWER ANY TWO QUESTIONS FROM THIS SECTION
QUESTION TWO (20 Marks)

a) Figure Q2ashows a trial slip circle.

i. On the given figure, sketch a few slices which would be used in slope stability analysis

ii. With reference to the figure and your sketches explain the method of slices in slope stability analysis.

[8marks]

b) An embankment has a slope of 30^o to the horizontal. The properties of the soil are $c = 30kN/m^2$, $\varphi = 20^o$ and $\gamma = 18kN/m^3$. . The height of the embankment is 27metres. Using Taylor's charts, determine the factor of safety of the slope. You are limited to TWO trials only.

[12marks]

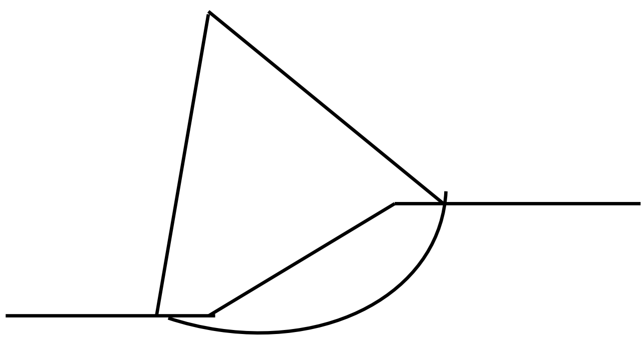

Fig 2aa Trial slip circle

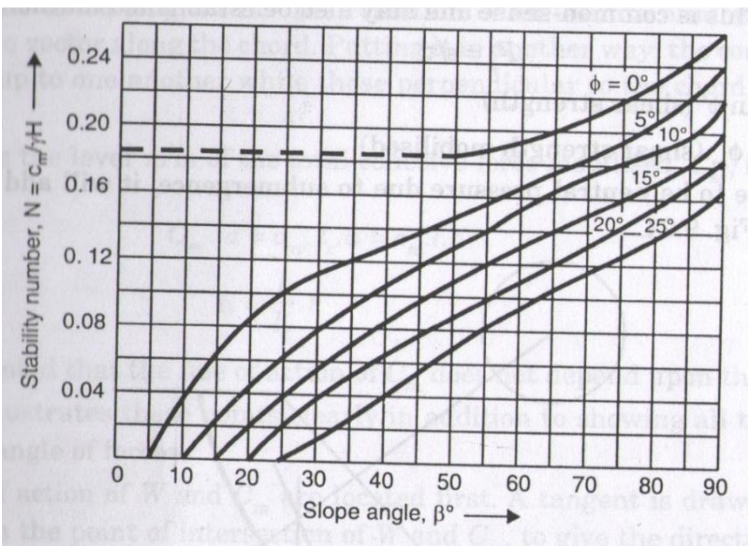

Fig. 9.25 Taylor's charts for slope stability (After Taylor, 1948)
(for $\phi = 0°$ and $\beta < 53°$, use Fig. 9.26)

QUESTION THREE (20 Marks)

a) From first principles derive an equation for the determination of bearing capacity of cohesion less soil based earth pressure analogy

[4marks]

b) Write down the Terzaghi's Equation for the calculation of ultimate bearing capacity of a square footing and explain its basis

[4marks]

c) A square footing measuring 2 metres by 2 metres is located at a depth of 1.2metres below the surface of a uniform sandy gravel of density 19.2 kN/m^3 above the water table and 20.1 kN/m^3 when submerged. The strength parameters with respect to effective stress are $c^1 = 0$ and $\Phi^1 = 30$. Find the ultimate bearing capacity for the following conditions

i. Water table is well below the foundation
ii. Water table rises to the base of the foundation
iii. Water table rises to the ground level
iv. In a design office with more time and resources what further information would be needed for the estimation of the allowable bearing capacity

[12marks]

QUESTION FOUR (20 Marks)

a) Discuss the occurrence of immediate and consolidation settlement for:

i) Cohesionless soils
ii) Cohesive soils

[5marks]

a) The formula for immediate settlement of flexible foundations was given by Terzaghi (1943) is given below. Explain the basis of the equation and define all the terms

$$s_i = \frac{pB(1-\upsilon^2)}{E} N_p$$

[5marks]

b) The plan of a proposed spoil heap is shown below. The tip will be about 20m high and will sit on a thick soft clay deposit ($E=15,000kN/m^2$). Assume that the density of the waste is $15kN/m^2$. Estimate the immediate settlement under the point A at the surface of the soil.

[10marks]

Typical values of $\mathbf{N_p}$

L/B		N_p	L/B	N_p
1		0.56	4	0.96
2		0.76	5	1
3		0.88