(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

(Main Campus)

UNIVERSITY EXAMINATIONS

2019/2020 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF

BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 321

COURSE TITLE: SOIL MECHANICS II

DATE: **FRIDAY 17TH JANUARY 2020** **TIME:** **3.00 – 5.00 PM**

Instructions to Candidates

- This paper contains FOUR (4) questions
- Answer ALL questions in Section A and **ANY** TWO (2) in Section B

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over ⟶

SECTION A: Answer ALL questions [30 *Marks*]

Question One

a) State the objectives of soil exploration **(2 Marks).**

b) State the limitation of shear box test. **(4 Marks).**

c) Explain briefly the following methods of soil improvement

i. Use of admixtures **(4 Marks).**

ii. Use of sand drains **(4 Marks)**

iii. Use geotextiles **(4 Marks).**

d) Explain how the following types of laboratory triaxial test are carried out and give example of field condition where you will specify each test to be carried to assess the shear strength of a soil.

i. Unconsolidated Undrained Test. **(4 Marks).**

ii. Consolidated Undrained Test. **(4 Marks).**

iii. Consolidated Drained test. **(4 Marks).**

Question two

Calculate the safety factor against overturning, for the retaining wall shown below (fig. Q2). **(20 Marks)**

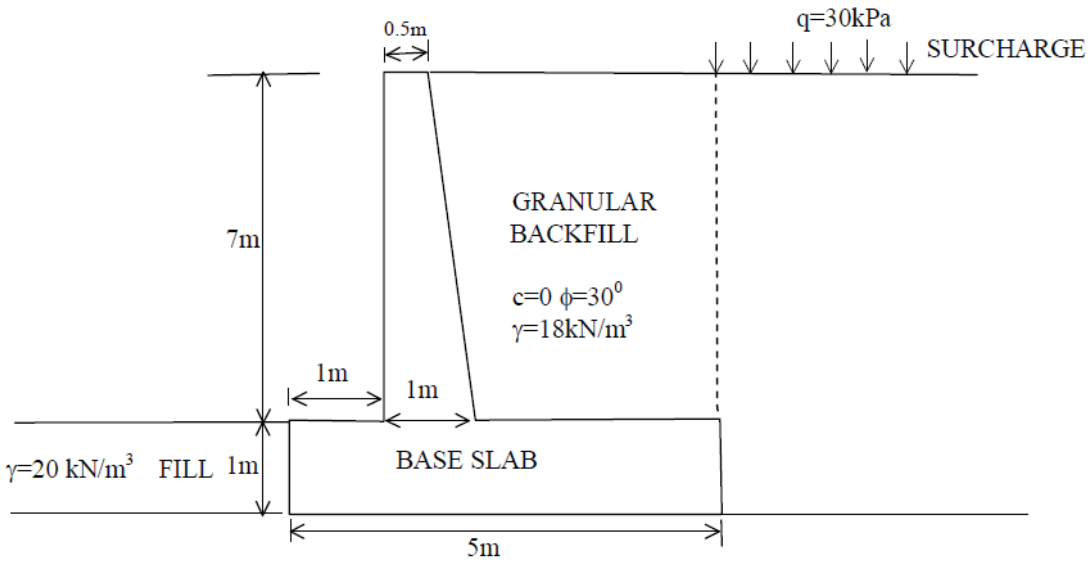

Fig. Q2

Question Three

Undrained Triaxial Compression test was conducted on specimens of clayey silt, the following results were obtained.

Specimen No.	**1**	**2**	**3**
Confining Pressure (σ_3) (kN/m^2)	17	44	56
Confining Pressure+ Deviator Stress (σ_1) (kN/m^2)	157	204	225
Pore Pressure (u) (kN/m^2)	12	20	22

Determine the values of shear parameters and shear strength of the soil considering

(a) Total Stresses **(8 Marks)**

(b) Effective stresses. **(12 Marks)**

Question Four

a) Explain five causes that may lead to failure of slopes. **(6 marks)**

b) Illustrate the following types of slope failures and give circumstances where they are likely to occur

i. Wedge Failure **(3marks)**

ii. Rotational slips **(4 marks)**

iii. Translational Failures **(3marks)**

c) Figure Q4 below shows the details of embankment made of cohesive soil with $\phi = 0^0$ and c=20kN/m^2. The unit weight of the soil is 19kN/m^3. Determine the factor of safety against sliding along the trial circle shown. The weight of the sliding mass is 400kN acting at eccentricity of 5.0m from the centre of rotation. Assume that no tension crack develops. The central angle is 70^0 **(4 marks)**

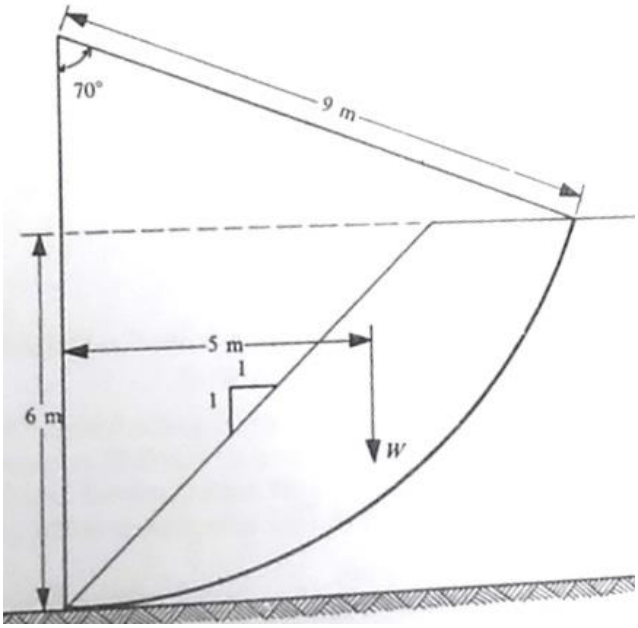

Fig Q4

EQUATIONS

EQUATION
$P_a = \frac{1}{2}(\gamma H^2 K_a - 2cH\sqrt{K_a}$
$P_a = \frac{1}{2}(H - z_c)\gamma H K_a - 2c\sqrt{K_a})$:
$= \sigma_v K_a - 2c\sqrt{K_a}$
$z_c = \frac{2c}{\gamma\sqrt{K_a}}$
$K_a = \tan^2(45 - \phi/2)$
$K_p = \tan^2(45 + \phi/2)$
$K_a = \cos\alpha \frac{\cos\alpha - \sqrt{\cos^2\alpha - \cos^2\phi}}{\cos\alpha + \sqrt{\cos^2\alpha - \cos^2\phi}}$
$\tau_f = c' + \sigma' \tan\phi'$
$\sigma_1 = \sigma_3 \tan^2\left(45 + \frac{\phi}{2}\right) + 2c\tan\left(45 + \frac{\phi}{2}\right)$
$F = \frac{c' L_a + \tan\phi' \sum_i \left(W_i \cos\alpha_i - u_i l_i\right)}{\sum_i W_i \sin\alpha_i}$
$F = \frac{1}{\sum_i W_i \sin\alpha_i} \cdot \sum_i \left\{ \left[c_i' b + W_i \left(1 - r_{u,i}\right) \tan\phi_i' \right] \frac{\sec\alpha_i}{1 + \left(\frac{\tan\phi_i' \tan\alpha_i}{F} \right)} \right\}$
If e $< \frac{B}{6}$ $q_{max} = \frac{\sum V}{B \times 1}\left(1 + \frac{6e}{B}\right)$ $q_{min} = \frac{\sum V}{B \times 1}\left(1 - \frac{6e}{B}\right)$ **If e** $> \frac{B}{6}$ $q_{max,new} = \frac{4\sum V}{3 \times 1 \times (B - 2e)}$