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(University of Choice)

**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY SPECIAL/SUPPLEMENTARY  
EXAMINATIONS  
2021/2022 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: 26<sup>TH</sup> JULY 2022**

**TIME: 8 A.M – 10 A.M**

**INSTRUCTIONS:**

1. This paper contains FIVE Questions
2. Answer Any FOUR Questions
3. Marks for each question are indicated in the parenthesis.
4. Useful formulae are provided at the end of the Question paper
5. Unit weight of water is  $9.81 \text{ kN/m}^3$  unless stated
6. Examination duration is 2 Hours

MMUST observes ZERO tolerance to examination cheating

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

**QUESTION ONE****[17½ Marks]**

a) A series of drained triaxial tests were carried out on specimens of a sand prepared at the same porosity and the following results were obtained at failure.

All round stress (kN/m <sup>2</sup> )	100	200	400	800
Principal stress difference (kN/m <sup>2</sup> )	452	908	1810	3624

Determine the shear parameters

[8 marks]

b) Describe any two methods for soil stabilization for engineering practice

[7 marks]

c) How does soil derive its shear strength?

[2½ marks]

**QUESTION TWO****[17½ Marks]**

a) For the retaining wall shown in Fig. Q2, determine the total resultant lateral earth force at rest per unit length of the wall. Also determine the location of the resultant earth pressure. Assume that the soil is a normally consolidated soil

[10 marks]

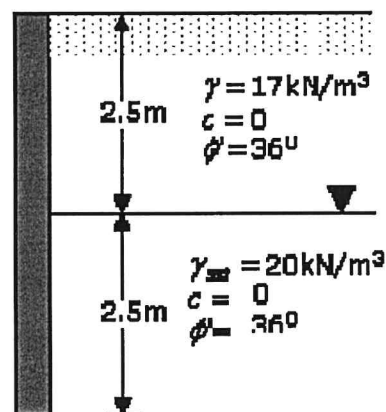


Figure Q2

b) Undrained shear box tests were carried out on a series of soil samples with the following results

Total normal stress (kN/m <sup>2</sup> )	100	200	300	400
Total shear stress at failure (kN/m <sup>2</sup> )	98	139	180	222

Determine the shear strength parameters

[7½ marks]

**QUESTION THREE****[17½ Marks]**

- a) Differentiate between normally consolidated and over consolidated clay  
[4 marks]
- b) A granular soil has a saturated unit weight of  $18.0 \text{ kN/m}^3$  and an angle of shearing resistance of  $30^\circ$ . A slope is to be made of this material. If the factor of safety is to be 1.25, determine the safe angle of slope when i) the slope is dry or submerged and ii) if the seepage occurs at and parallel to the surface of the slope.  
[6 marks]
- c) A soil retained behind a 7.5 m smooth wall has soil with  $16.0 \text{ kN/m}^3$  an angle of shearing friction of  $30^\circ$  and cohesion = 0 for the first 3 m from the soil surface and soil of unit weight of  $24.0 \text{ kN/m}^3$  an angle of shearing friction of  $20^\circ$  and cohesion = 0 for the remaining part of the wall. Determine the horizontal active thrust acting on the back of the wall according to Rankine theory. [7½ marks]

**QUESTION FOUR****[17½ Marks]**

- a) Describe how stability of retaining wall is checked [8 marks]
- b) Differentiate between consolidated-drained test (CD test) or consolidated-undrained test (CU test) [4 marks]
- c) You have consulted to advice on construction in expansive soils. Describe your advice [5½ marks]

**QUESTION FIVE****[17½ Marks]**

- a) Explain the significance and procedure for determining CBR test in soils  
[7½ marks]
- b) Outline the causes of slope failure [4 marks]
- d) Outline the merits and demerits of cone penetrometer test (CPT) [6 marks]
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## FORMULAE SHEET

$$\gamma_a = \left( \frac{G_s}{1+e} \right) \gamma_w$$

$$\gamma_b = \left( \frac{G_1 - 1}{1+e} \right) \gamma_w$$

$$\gamma_{sat} = \left( \frac{G_s + e}{1+e} \right) \gamma_w$$

$$\gamma_b = \gamma_{sat} - \gamma_w$$

$$\sigma' = \sigma - u$$

$$F_s = \frac{s}{\tau} = \frac{c' + \sigma' \tan \phi'}{\tau}$$

$$\tau = \frac{c'}{F_s} + \sigma' \frac{\tan \phi'}{F_s}$$

or  $\tau = c'_m + \sigma' \tan \phi'_m$

where  $c'_m = \frac{c'}{F_s}$ ,  $\tan \phi'_m = \frac{\tan \phi'}{F_s}$

$$\tau = \frac{c'}{F_H} + \sigma' \tan \phi'$$

$$K_a = \cos \beta \cdot \frac{\cos \beta - \sqrt{\cos^2 \beta - \cos^2 \phi}}{\cos \beta + \sqrt{\cos^2 \beta - \cos^2 \phi}}$$

$$k_p = \cos \beta \frac{\cos \beta + \sqrt{\cos^2 \beta - \cos^2 \phi}}{\cos \beta - \sqrt{\cos^2 \beta - \cos^2 \phi}}$$

$$p_p = k_p \gamma H + 2c \sqrt{k_p}$$

$$P = \frac{1}{2} k_p \gamma H^2 + 2cH \sqrt{k_p}$$

$$p_a = k_a \gamma H - 2c \sqrt{k_a}$$

$$P = \frac{1}{2} k_a \gamma H^2 - 2cH \sqrt{k_a}$$

$$k_{ac} = \frac{\sin^2(\beta + \phi)}{\sin^2 \beta \sin(\beta - \delta) \left[ 1 + \sqrt{\frac{\sin(\phi + \delta) \sin(\phi - \alpha)}{\sin(\beta - \delta) \sin(\alpha + \beta)}} \right]^2}$$

$$k_{pc} = \frac{\sin^2(\beta - \phi)}{\sin^2 \beta \sin(\beta + \delta) \left[ 1 - \sqrt{\frac{\sin(\phi + \delta) \sin(\phi + \alpha)}{\sin(\beta + \delta) \sin(\alpha + \beta)}} \right]^2}$$

no seepage

$$N_s = \frac{c'}{\gamma_d H_c} = \cos^2 \beta (\tan \beta - \tan \phi') \quad \text{when } F_\phi = 1$$

When there is seepage

$$N_s = \frac{c'}{F_c \gamma_{sat} H} = \frac{c'}{\gamma_{sat} H_c} = \cos^2 \beta \tan \beta - \frac{\gamma_b}{\gamma_{sat}} \tan \phi'$$

For submerged

$$N_s = \frac{c'}{F_c \gamma_b H} = \frac{c'}{\gamma_b H_c} = \cos^2 \beta (\tan \beta - \tan \phi')$$

where  $\gamma_b$  = submerged unit weight of the soil.

$$P_{toe} = \frac{F_v}{B} + \frac{6M}{B^2}$$

$$P_{heel} = \frac{F_v}{B} - \frac{6M}{B^2}$$

$$e = \frac{M}{F_v} \leq \frac{B}{6}$$



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**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS**

**2021/2022 ACADEMIC YEAR**

**2<sup>ND</sup> YEAR SEMESTER ONE SPECIAL /SUPPLEMENTARY  
EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR TECHNOLOGY EDUCATION (BUILDING AND  
CIVIL TECHNOLOGY)**

**COURSE CODE: TEB 213  
COURSE TITLE: CONSTRUCTION TECHNOLOGY &  
PRACTICE 1**

**DATE: 26<sup>TH</sup> JULY 2022**

**TIME: 3 P.M – 5 P.M**

**INSTRUCTIONS:**

1. This paper consists of **FOUR** questions.
2. **ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS.**
3. Marks for each question are indicated in the parenthesis.
4. **THE TIME FOR THIS EXAMINATION IS STRICTLY 2 HOURS**

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

**Question ONE (30 Marks)**

- a) What is site planning? Briefly highlight the importance of site planning. [2 Marks]
- b) What is site development? [2 Marks]
- c) Highlight any **FOUR** considerations to be undertaken by the project developers for the efficient and safe storage of materials. [4 Marks]
- d) What is desk study? Briefly describe **FOUR** main aims/benefits of conducting desk study. [4 Marks]
- e) Highlight **FOUR** evidences that need to be carefully considered during the site reconnaissance process. [4 Marks]
- f) Highlight **TWO** advantages and **TWO** disadvantages of using steel formwork during concreting activities. [4 Marks]
- g) What is a bulldozer? Highlight **THREE** main uses of a bulldozer as heavy construction equipment. [4 Marks]
- h) Highlight **THREE** design principles/ requirements for a conducive building suitable for occupation. [3 Marks]
- i) Outline in the consecutive order, the **SIX** steps employed in the setting out of a building. [3 Marks]

**Question TWO (20 marks)**

- a) What is site investigation? Outline **FOUR** main purposes of site investigation to the project developers. [3 Marks]
- b) Briefly describe the **THREE** phases of site investigation. [3 Marks]
- c) What is soil laboratory testing? [1 Marks]
- d) Mention **FIVE** types of soil testing, giving two parameters being tested in each case. [5 Marks]
- e) Highlight **FOUR** items that are necessary to be reported in the site investigation report. [4 Marks]
- f) Briefly describe the mud rotary method of wash boring. [4 Marks]

**Question THREE (20 marks)**

- a) What is formwork? [1 Marks]
- b) Highlight **FIVE** qualities of a good formwork [5 Marks]
- c) Highlight **FOUR** basic requirements of formwork. [4 Marks]
- d) Describe **THREE** factors that determine the removal time of formwork. [3 Marks]
- e) Describe **THREE** classes/types of loads that are being supported by formwork. [3 Marks]
- f) Highlight **FOUR** factors that control the cost of formwork. [4 Marks]

**Question FOUR (20 Marks)**

- a) Highlight **THREE** advantages of utilizing the construction equipment. [3 Marks]
- b) Highlight **FOUR** factors to be considered during the planning of the number of earthmoving equipment that would be needed for a given job to be undertaken. [4 Marks]
- c) Outline **EIGHT** suitable applications of an excavator. [4 Marks]
- d) Discuss **FOUR** ways in which a contractor can employ to acquire a mechanical plant for his construction works. [6 Marks]
- e) Highlight **THREE** advantages of renting a construction equipment over outright ownership. [3 Marks]