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

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS**

**2021/2022 ACADEMIC YEAR**

**SECOND YEAR SEMESTER TWO EXAMINATION**

**FOR THE DEGREE  
OF  
BACHELOR OF TECHNOLOGY EDUCATION IN BUILDING  
AND CIVIL TECHNOLOGY**

**COURSE CODE: TEB 222**

**COURSE TITLE: SOIL MECHANICS II**

**DATE: TUESDAY 19<sup>TH</sup> APRIL 2022 TIME: 3.00 – 5.00 PM**

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**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 examination is 2 hours.
5. **Do not write on the question paper**

MMUST observes **ZERO** tolerance to examination cheating

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

2021/2022

**Question ONE (30 Marks)**

- a) What do you understand by the term soil according to engineering point of view? [1 Marks]
- b) Briefly explain what you understand by the term “Soil Mechanics” according to Terzaghi (1948). [2 Marks]
- c) Briefly explain the **THREE** Atterberg limits. [3 Marks]
- d) A sample of dry course-grained materials of mass 500 grams was shaken through a series of sieves and the results tabulated below were obtained.

Sieve Size (mm)	mass retained, (g)
4.75	0
2.00	14.8
0.85	98
0.425	90.1
0.15	181.9
0.075	108.8
PAN	6.1

- Plot the particle distribution and use the graph to determine: [7 Marks]
- Uniformity coefficient ( $C_u$ )
  - Coefficient of gradation ( $C_c$ )
- e) With the aid of a diagram/sketch, describe the working principle of constant head test in determining the coefficient of permeability. [5 Marks]
- f) Define the following terms as used in soil phase diagram. [4 Marks]
- Bulk density
  - Specific gravity
  - Submerged density
  - Degree of saturation
- g) An undistributed sample of saturated clay has a volume of 16.5cm<sup>3</sup> and weighs 35.1gm. On oven drying, the weight of the sample reduces to 29.5gm. Determine the moisture content, dry density, the void ratio and the specific gravity of solids. [8 Marks]

**Question TWO (20 marks)**

- a) Define soil compaction. [1 Marks]
- b) Explain how the following factors influence compaction of soils. [3 Marks]
- Water content of the soil
  - Amount of compaction
  - Thickness of layer to be compacted
- c) Outline **THREE** unique differences between the Standard Proctor Test and the Modified Proctor Test. [3 Marks]
- d) Briefly describe the Standard Proctor Test method of compaction. [4 Marks]
- e) The results of a standard Proctor Test are given in the following table. Determine the maximum dry unit weight of compaction and the optimum moisture content. [9 Marks]

**Table 1: For question 2**

Volume of proctor mold (cm <sup>3</sup> )	944	944	944	944	944	944	944	944
Mass of wet soil in the mold (kg)	1.69	1.72	1.77	1.82	1.85	1.88	1.87	1.85
Water content (%)	9.9	10.5	12.2	13.9	15.1	17.3	19.4	21.2

**Question THREE (20 marks)**

- a) Define permeability of soil. [2 Marks]
- b) Understanding soil permeability is of great importance to soil/geotechnical engineer. Outline **FOUR** areas of applications that illustrates the importance of permeability in geotechnical design. [4 Marks]
- c) Explain how the following factors influence the permeability of a given soil. [4 Marks]
- (i) Particle size
  - (ii) Void ratio
  - (iii) Degree of saturation
  - (iv) Temperature
- d) A constant head test for permeability of a certain soil sample generated the following test results:  $L=300$  mm, and  $A=110$  cm<sup>2</sup>. If the value of  $k=0.02$  cm/sec and a flowrate of 140 cm<sup>3</sup>/min must be maintained through the soil. Determine. [6 Marks]
- (i) The head difference  $h$  across the specimen
  - (ii) The discharge velocity under the test condition.
- e) For a variable – head test, the following results were obtained. Length of specimen = 38 cm, area of specimen = 6.5 cm<sup>2</sup>;  $k=0.175$  cm/min. determine the area of the standpipe for the head to drop from 6500mm to 3000 mm in 480 seconds. [4 Marks]

**Question FOUR (20 Marks)**

- a) Define the following terms. [3 Marks]
- (i) Total vertical stress
  - (ii) Pore water pressure
  - (iii) Effective pressure
- b) A clay layer 4 m thick rests beneath a deposit of submerged sand 7 m thick. The top of the sand is located 2.8 m below the surface of a lake. The saturated unit weight of the sand is 20.13 kN/m<sup>3</sup> and that of clay is 18.5 kN/m<sup>3</sup>. Determine (a) the total vertical pressure, (b) the pore water pressure and (c) the effective vertical pressure at the bottom of the clay layer. [7 Marks]
- c) Explain **THREE** importance of Atterberg limits. [6 Marks]
- d) Highlight any **FOUR** limitations of sieve analysis as a method of determining the particle size distribution of soils. [4 Marks]