MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

2ND YEAR SEMESTER TWO SPECIAL / SUPLEMENTARY EXAMINATION

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

COURSE CODE: TEB 222

COURSE TITLE: SOIL MECHANICS

DATE: 2ND AUGUST 2022   **TIME: 11 A.M – 1 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 examination is 2 hours.
5. **Do not write on the question paper**

MMUST observes ZERO tolerance to examination cheating

Question ONE (30 Marks)

a) What do you understand by the term soil according to engineering point of view? **[1 Marks]**

b) Briefly explain the **THREE** Atterberg limits. **[3 Marks]**

c) With the aid of a diagram/sketch, describe the working principle of constant head test in determining the coefficient of permeability. **[5 Marks]**

d) Define the following terms as used in soil phase diagram. **[3 Marks]**
   (i) Bulk density
   (ii) Submerged density
   (iii) Degree of saturation

e) An undistributed sample of saturated clay has a volume of 16.5cm3 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]**

f) Define the following terms. **[3 Marks]**
   Total vertical stress
   Pore water pressure
   Effective pressure

g) 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/m3 and that of clay is 18.5 kN/m3. 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]**

Question TWO (20 marks)

a) Define soil compaction. **[1 Marks]**

b) Explain how the following factors influence compaction of soils. **[3 Marks]**
   (i) Water content of the soil
   (ii) Amount of compaction
   (iii) 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 (cm3)	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^2. If the value of k=0.02 cm/sec and a flowrate of 140 cm^3/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^2; 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) Outline any FOUR reasons to studying properties of soil.   **[2 Marks]**

b) Explain THREE importance of Atterberg limits.   **[6 Marks]**

c) Highlight any **FOUR** limitations of sieve analysis as a method of determining the particle size distribution of soils.   **[4 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.   **[8 Marks]**
   i.   Uniformity coefficient (C_u)
   ii. Coefficient of gradation (C_c)