



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

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2021 / 2022 ACADEMIC YEAR

**2ND YEAR SEMESTER ONE SPECIAL / SUPPLEMENTARY
EXAMINATION**

**FOR THE DEGREE
OF
BACHELOR OF TECHNOLOGY IN BUILDING CONSTRUCTION**

COURSE CODE: BTB 221

COURSE TITLE: SOIL MECHANICS I

DATE: 29TH JULY 2022

TIME: 8 AM – 10 AM

INSTRUCTIONS:

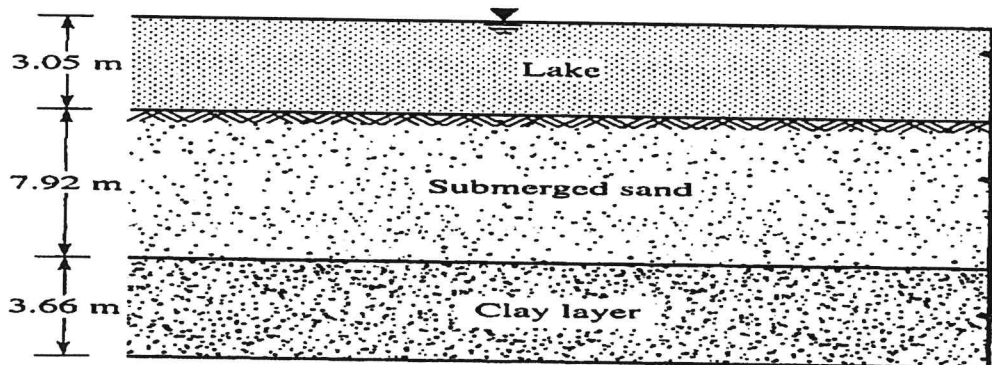
1. This paper consists of **FOUR** questions.
2. **ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS.**
3. Marks for each question are indicated in the parenthesis.
4. The paper is 2 hours.
5. **Do not write on the question paper**

MMUST observes ZERO tolerance to examination cheating

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

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". [2 Marks]
- c) Outline any **FOUR** reasons to study the properties of soil. [2 Marks]
- d) State and explain **FIVE** factors influencing soil formation processes. [5 Marks]
- e) Define the following terms. [3 Marks]
- i. Total vertical stress
 - ii. Pore water pressure
 - iii. Effective pressure
- f) A clay layer 3.66 m thick rests beneath a deposit of submerged sand 7.92 m thick. The top of the sand is located 3.05 m below the surface of a lake. The saturated unit weight of the sand is 19.62 kN/m^3 and that of clay is 18.36 kN/m^3 . Determine the following pressures at the mid height of the clay layer. [7 Marks]
- i. The total vertical pressure
 - ii. The pore water pressure
 - iii. The effective vertical pressure



- g) Outline **THREE** comparisons between consolidation and compaction. [6 Marks]
- h) Highlight any **FOUR** assumptions based on the derivation of the time rate of consolidation. [4 Marks]

Question TWO (20 marks)

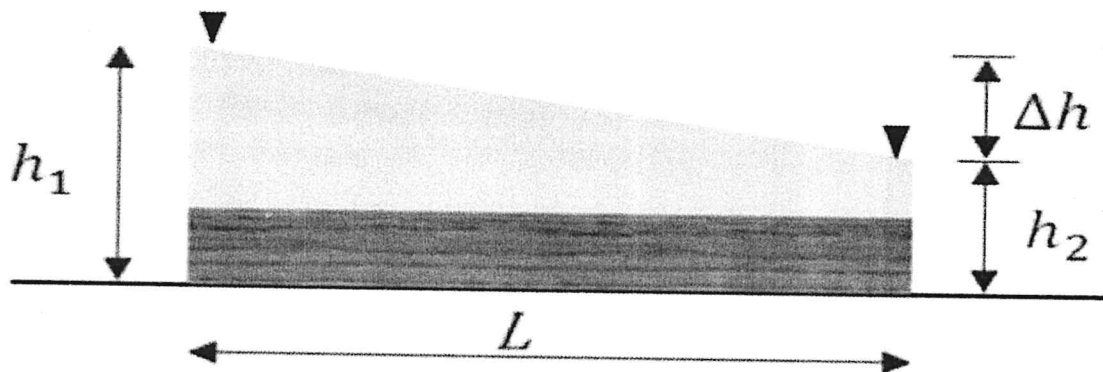
- a) Define soil compaction. [1 Marks]
- b) Explain **THREE** purposes of compacting soil during construction. [3 Marks]
- c) Explain how the following factors influence compaction of soils. [3 Marks]
- Water content of the soil
 - Soil type
 - Compactive efforts
- d) Briefly describe the Standard Proctor 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. Also determine the moisture content required to achieve 95% of $(\gamma_{dry})_{max}$. [9 Marks]

Table 1: For question 2

Volume of proctor mold (cm ³)	944	944	944	944	944	944	944	944
Mass of wet soil in the mold (kg)	1.68	1.71	1.77	1.83	1.86	1.88	1.87	1.85
Water content (%)	9.9	10.6	12.1	13.8	15.1	17.4	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) Outline **FOUR** basic conditions that satisfies validity of Darcy's Law. [4 Marks]
- d) A constant head test for permeability of a certain soil sample generated the following test results: $L=400$ mm, $A=135$ cm², $\Delta h = 450$ mm, water collected in 3 min = 640 cm³, void ratio of soil = 0.54. determine the following components. [6 Marks]
- Coefficient of permeability
 - Seepage velocity



- e) For a variable – head test, the following results were obtained. Length of specimen = 380 mm, area of specimen = 6.5 cm²; k=0.175 cm/min. determine the area of the standpipe for the head to drop from 650cm to 300 cm in 8 minutes. [4 Marks]

Question FOUR (20 Marks)

- a) Briefly explain **THREE** soil formation processes and give an example in each case. [3 Marks]
- b) With the aid of a diagram/sketch, describe the working principle of constant head test in determining the coefficient of permeability. [5 Marks]
- c) Define the following terms as used in soil phase diagram. [4 Marks]
- (i) void ratio
 - (ii) Porosity
 - (iii) Water content
 - (iv) Degree of saturation
- d) A saturated soil sample weighing 178gm has a volume of 96cm³; if the specific gravity of soil solids is 2.67, determine. [8 Marks]
- (i) Unit weight of the soil
 - (ii) Void ratio
 - (iii) Water content