TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of BUILDING & Civil engineering

**UNIVERSITY EXAMINATION FOR:**

DIPLOMA IN CIVIL ENGINEERING
**DCE 2106: GEOTECHNOLOGY I**

END OF SEMESTER EXAMINATION
SERIES: APRIL 2025
TIME: 2 HOURS

**Instructions to Candidates**

You should have the following for this examination
*-Answer Booklet, Calculator, examination pass and student ID*
This paper consists of five questions.
Attempt any THREE questions.
**Do not write on the question paper.**

**QUESTION ONE (20 Marks)**

(a) Explain FOUR factors upon which soil characteristics depend. (6 Marks)

(b) A sample of soil weighing 29.8 kg had a volume of 0.0175 $m^3$. When dried out in an oven its weight reduced to 25.6 kg. If the specific gravity of the soil solids was 2.65, determine the following soil properties:

(i) Bulk density
(ii) Dry density
(iii) Percentage moisture content
(iv) Percentage air voids
(v) Void Ratio (10 Marks)

(c) Describe Residual Soils, stating typical examples. (4 Marks)

**QUESTION TWO (20 Marks)**

a) In regard to grading curve, briefly explain the following terms:
   (i) Effective size
   (ii) Coefficient of curvature
   (iii) Coefficient of uniformity (6 Marks)

b) The following results were recorded during a Cone Penetrometer test on a cohesive soil:

TABLE 1

| Penetration (mm) | 15.2 | 17.3 | 18.9 | 21.1 | 22.8 |
|---|---|---|---|---|---|
| Moisture Content (%) | 33.4 | 42.6 | 49.2 | 59.4 | 66.8 |

   (i) Determine its liquid limit
   (ii) If the plastic limit of the soil was found to be 33%, determine its plasticity index and classify the soil. Use graph paper and Plasticity Chart.
   (14 Marks)

**QUESTION THREE (20 Marks)**

a) Explain FOUR factors affecting permeability. (4 Marks)

b) A borehole on a building site has the following log as shown below:
   0-2 m Sand: $\rho_b$ = 1930 kg/m$^3$
   2-4 m Saturated sand: $\rho_{sat}$ = 2125 kg/m$^3$
   4-6 m Saturated Clay: $\rho_{sat}$ = 2010 kg/m$^3$

   Determine the effective stress at the base of clay. (6 Marks)

c) A sheet pile wall retaining water on one side 5.0m high from the ground is driven 6.5m into permeable soil. The permeable stratum is 13 m thick. Below this there is an impermeable stratum. The permeability of the soil is 0.0015 mm/s. Draw a flow net and estimate the seepage under the sheet pile wall in m$^3$/day. (8 Marks)

**QUESTION FOUR (20 Marks)**

a) In a BS compaction test on a soil of specific gravity 2.70, the following data were collected:

TABLE 2

| Bulk Density (Kg/m3) | 1870 | 2040 | 2150 | 2200 | 2160 | 2090 |
|---|---|---|---|---|---|---|
| Moisture Content (%) | 5 | 8 | 10 | 13 | 16 | 19 |

(i) Using graphical method, determine the compaction parameters

(ii) Calculate the moisture content if the soil were compacted at 100% saturation to the maximum dry density. (16 Marks)

b) Identify and explain TWO factors influencing compaction. (4 Marks)

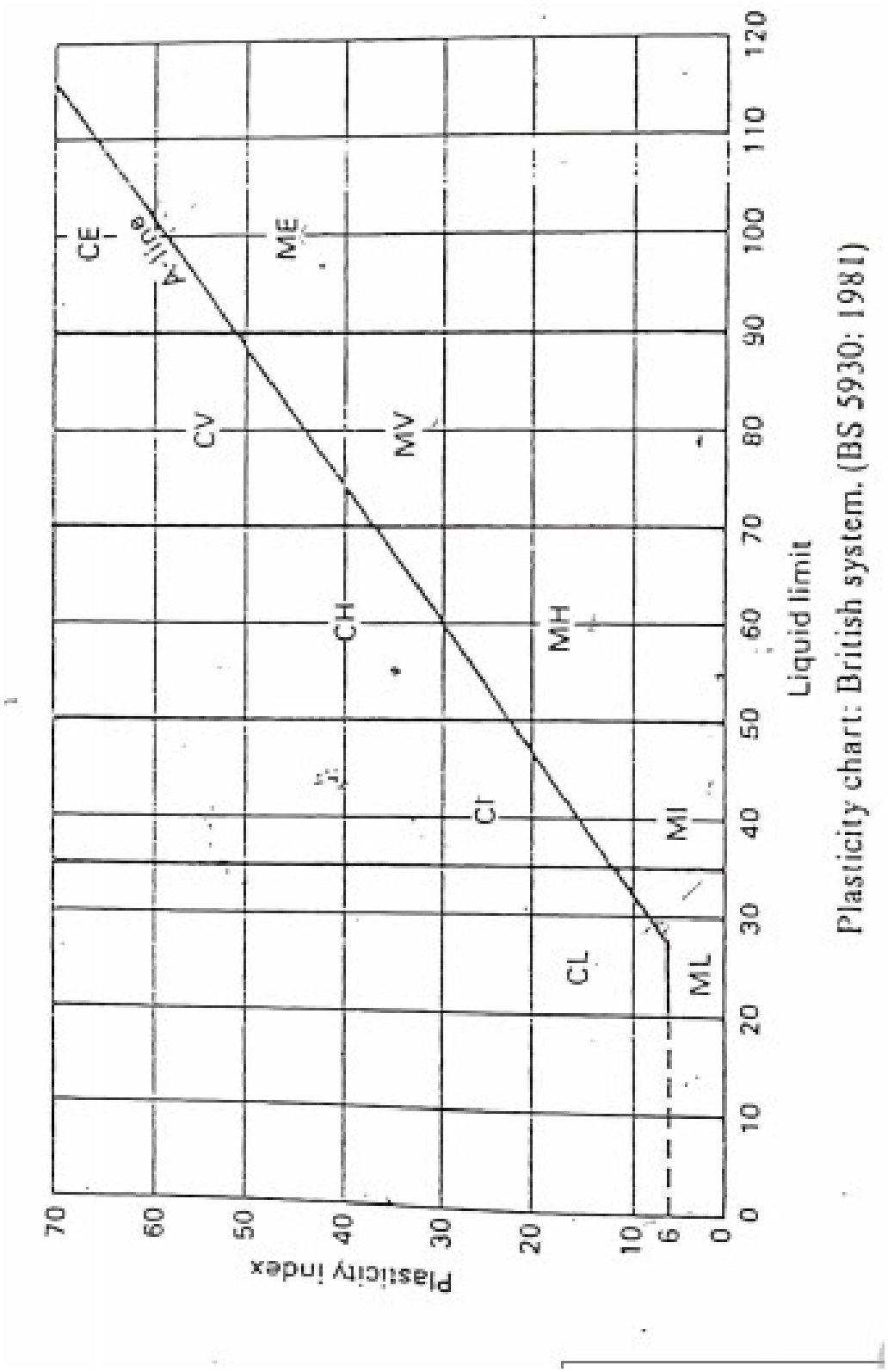
**QUESTION FIVE (20 Marks)**

a) Describe the formation process of sedimentary rocks. (6 Marks)

b) Identify and explain THREE metamorphic textures. (6 Marks )

c) Explain the term Geology. (2 Marks)

d) In regard to igneous rocks, explain the site distinction of intrusives from extrusives (6 Marks)




Plasticity chart: British system. (BS 5930: 1981)