



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING AND CIVIL ENGINEERING (DBC II)

DIPLOMA IN CIVIL ENGINEERING (DC II)

EBC 2216: SOIL MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Scientific calculator*
- *Graph Papers (2No)*
- *Plasticity Chart*

This paper consists of **FIVE** questions. Answer question any **THREE** questions
 Maximum marks for each part of a question are as shown
 This paper consists of **THREE** printed pages

Question One (20 Marks)

- a) Briefly describe the variable head permeameter test **(6 marks)**
- b) Explain **FOUR** factors that influence permeability. **(8 marks)**
- c) A pumping test was carried out for determining coefficient of permeability of soil in place. A well of diameter 40cm was drilled up to impermeable stratum. The depth of the water bearing stratum was 9m. The yield from the well was $5\text{m}^3/\text{min}$ at a steady draw-down of 5m. Determine the coefficient of permeability in m/day if the observed radius of influence was 160m. **(6 marks)**

Question Two (20 Marks)

- a) Outline the standard compaction test. **(7 marks)**
- b) A standard Proctor compaction test carried out on a sandy clay of specific gravity 2.55 gave the following results:

Table 1:

Bulk Density (Kg/m³)	218	2160	2155	2140	2125	2058
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Moisture Content (%)	22	18.2	16.8	15.1	14.5	12.5

- 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. **(13 marks)**

Question Three (20 Marks)

- a) (i) Define the term ‘moisture content’
 (ii) Table 2 shows data recorded during a moisture content test:

Table 2:

Mass of Tin (Empty) g	16.24	16.18
Tin + Wet Soil (g)	29.30	27.71
Tin + Dry Soil (g)	26.96	25.66

- Calculate the moisture content of the soil tested. **(6 marks)**
- b) Derive the expression of dry density in terms of density of water, particles specific gravity and void ratio. **(6 marks)**
- c) Explain the **FOUR** main areas where soil mechanics is of great importance. **(8 marks)**

Question Four (20 marks)

- a) Define the following terms as applied to shear strength:

- i) Principal plane
- ii) Principal stress

(2 marks)

- b) In a series of unconsolidated-undrained triaxial tests on specimens of a fully saturated clay, the following results were obtained at failure.

Table 3:

All Round Pressure (KN/m²)	200	400	600
Principal Stress Difference (KN/m²)	222	218	220

Determine the values of shear strength parameters.

(8 marks)

- c) A borehole on a building site has the soil profile as shown in figure 1. Determine the effective stress at the centre of the clay stratum:

- i) Under normal conditions

- ii) When the ground water level is lowered by 3m, and assuming that the sand remains saturated up to the water table.

(10 marks)

Impermeable Shale

Question Five (20 marks)

- a) Explain the following terms:

- i) Liquid limit
- ii) Plastic limit
- iii) Shrinkage limit

(4 ½ marks)

- b) The following results were obtained from a liquid limit test on a certain soil:

Table 4:

Penetration (mm)	15.6	18.2	21.4	23.6
Moisture Content (%)	48.6	54.6	62.2	67.4

A plastic limit test for the same soil gave a value of 22%. Classify the soil using the plasticity chart.

(6 ½ marks)

c) Outline the sieve analysis test.

(6 marks)

d) Define the following terms:

i) Effective size

ii) Uniformity coefficient

(3 marks)