



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

BRIDGING TO HIGHER DIPLOMA (BHD 11)

EBC 2418: SOIL MECHANICS

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Scientific Calculator*
- *2 No. Graph Papers*
- *Particle Size Distribution Chart*

This paper consists of **FIVE** questions

Answer question **ONE (COMPULSORY)** from **SECTION A** and any other **TWO** questions from **SECTION B**

Maximum marks for each part of a question are clearly shown

This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1

- a) (i) State the **FIVE** main factors upon which characteristics of soils depend.
(ii) Explain the term transported soil (8 marks)

- b) The following data relating to a soil sample was obtained from laboratory measurements:
- Volume of sample = 0.022m³
 - Mass of sample before drying = 36.90kg
 - Mass of sample after drying = 32.82 kg
 - Specific gravity of soil particles = 2.652.

Determine each of the following properties of the sample:

- (i) Bulk density
(ii) Moisture content
(iii) Void ratio
(iv) Degree of saturation
(v) Porosity (12 marks)
- c) Table 1 shows the results of a proctor compaction test. Plot the curve of dry density against moisture content, and hence determine the maximum dry density and optimum moisture content. (10 marks)

Table 1

Bulk density (kg/m ³)	2057	2141	2151	2158	2139
Moisture content (%)	12.8	14.2	15.6	16.8	17.8

SECTION B (Answer any TWO questions from this section)

Question 2

- a) Define the following terms:
(i) Liquid limit
(ii) Plastic limit
(iii) Shrinkage limit (6 marks)

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

Table 2

Penetration (mm)	15.6	18.2	21.4	23.6
Moisture content (%)	48.6	54.8	62.2	67.4

A plastic limit test gave a value of 22 per cent classify the soil using the plasticity chart (fig 1) (10 marks)

- c) Define the following grading characteristics:
(i) Coefficient of uniformity
(ii) Coefficient of curvature (4 marks)

Question 3

- a) Define the following terms as used in shear strength:
- (i) Principal plane
 - (ii) Principal stress
- (4 marks)
- b) The data in table 3 refers to tri-axial tests performed on an undisturbed soil samples. The load dial calibration factor is 1.4N per division. Each sample is 75mm long and 37.5mm diameter. Plot a graph to determine the value of apparent cohesion, and the angle of internal friction for the soil
- (14 marks)

Table 3

Test	Cell Pressure (KN/m ³)	Axial load dial reading (division at failure)
1	50	65
2	150	105
3	250	146

- c) Explain the term shear strength
- (2 marks)

Question 4

- a) Explain **FOUR** factors that affect permeability
- (8 marks)
- b) Outline the variable head permeameter test
- (6 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 of the water bearing stratum was 9m. The yield from the well was 4m³/min at a steady draw-down of 4.5m. Determine the coefficient of permeability in m/day if the observed radius of influence was 140m.
- (6 marks)

Question 5

- a) The results of a dry-sieving test are given in Table 4. Plot the particle-size distribution curve and give a classification for the soil.

Table 4

μm	3.35	2.0	1.18	6000	425	300	212	150	63
Sieve size (mm or μm)									
Mass retained (g)	0	2.6	12.5	57.7	62.0	34.2	18.7	12.7	13.1

The quantity passing the 63 μm sieve and collected in the pan was 3.9g, and the original quantity was 217.2g. Use chart 1

(14 marks)

- b) Outline **THREE** factors which affect soil compaction
- (6 marks)