



TECHNICAL UNIVERSITY OF MOMBASA
**Faculty of Engineering &
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING
DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 13J)

EBC 2206: SOIL MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: JULY 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Scientific Calculator*
- *Mathematical Table*

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

Question One

- a) Outline negative effects caused by clay mineral content to a constructed site. **(6 marks)**

- b) Explain the following terms:
 - (i) Coefficient of uniformity
 - (ii) Saturated dry density **(4 marks)**

- c) A student tests a clayey SAND and finds its saturated density to be 1.950Mg/m^3 , moisture content being 24.5%. Use a soil model to determine:
 - (i) Porosity
 - (ii) Dry density
 - (iii) Particle specific gravity
 - (iv) Bulk density of the soil if the soil is 75% saturated. **(10 marks)**

Question Two

- a) Briefly explain the following terms:
 - (i) Flocculation as applied to clayey sediments
 - (ii) Two aspects of British soil classification system
 - (iii) Plasticity index with respect to soil classification. **(6 marks)**

- b) Result of particle size distribution investigation area:

Particle size (mm)	50	37.5	20	14	10	6.3	5	3.3	2.0	1.1	0.42	0.21	0.15	0.006	0.01
Mass retained (g)	0	15.5	17	10	11	33	33.5	81	18	31	32.5	9	8	5.5	5

- c) The soil in 2(b) was found to be organic and results for liquid limit test conducted on its five content are:

Test number	1	2	3	4
Moisture content (%)	49	46	44	43
Number of blows	1	20	32	41

If plastic limit for the soil was 35%, use figures 2 and 3 as well as results obtained in (b) above to classify the soil.

Question Three

- a) State THREE possible causes of errors in soil compaction methods.

- b) Outline THREE objectives of compacting soils **(3 marks)**

- c) Proctor method of test was carried out on a soil sample of specific gravity 2.68 and following results were obtained.

Test Number	1	2	3	4	5
Bulk Density (kg/m ³)	200 5	208 7	211 0	210 0	205 5
Moisture Content (%)	12. 8	14. 5	15. 6	16. 8	19. 2

Volume for the mould used in the compaction was 1000cm³

- (i) Draw a compaction graph
- (ii) Determine compaction parameters
- (iii) Determine the following, at the compaction parameters obtained in (c) (ii)
 - Air voids ratio
 - Moisture content

(11 marks)

Question Four

- a) A student compacted first three soil samples using 2.5kg rammer. He then used a 4.5kg rammer compact last 3 samples. Explain possible effect that the change could cause. **(2 marks)**
- b) Compare results obtained from compaction of sandy GRAVEL and clayey SILT when plotted on same axes. **(4 marks)**
- c) Outline FOUR factors that affect soil compaction. **(8 marks)**

- d) A silt soil sample was tested in the laboratory in 2 stages. In stages 1 the following results were obtained.

Diameter of standpipe used (mm) = 12
 Diameter of test sample (mm) = 60
 Length of the test sample (mm) = 48
 Initial water level in stand pile (mm) = 1200
 Final water level in the pipe (mm) = 800
 Time taken for the water level to decrease = 3 minutes, 20 seconds.

- (i) Determine the coefficient of permeability
- (ii) In stage 2 of the test, the soil sample was reduced to $\frac{3}{4}$ of its original length. Answer soil sample of permeability 7.5×10^{-3} mm/s was then added to it and experiment repeated. Determine expected permeability for both layers considering.
 - Vertical flow direction
 - Horizontal flow direction

(5 marks)

Question Five

- a) Outline FOUR factors that affect permeability of muddy sediments **(4 marks)**

b) Outline liquid limit determination method in which a standard cone penetrometer is used. **(12 marks)**

c) Results of state 1 of a permeability test are as follows:

- Radius of stand pipe (mm)	=	6
- Cross-sectional area of test sample (mm ²)	=	2800
- Length of the sample (mm)	=	50
- Initial water level in stand pipe (mm)	=	1000
- Final water level in the pipe (mm)	=	600
- Time taken for the water level to decrease	=	2 minutes 58 seconds

(i) Determine coefficient of permeability

(ii) The test sample in (i) is reduced to one half of its original length and soil of permeability 8.0×10^{-3} mm/s added. Test is repeated for different directions of flow through combined samples. Determine coefficient of permeability considering the following directions:

- Vertical
- Horizontal