



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2303 : SOIL MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of five questions.

Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE (COMPULSORY) 30 Marks

- (a) With aid of sketches, discuss FOUR factors that affect permeability.
(8 Marks)
- (b) The results of a liquid limit are shown in table 1.

TABLE 1

Cone Penetration (mm)	15.5	18.0	19.4	22.2	24.0
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Water content	39.3	40.8	42.1	44.6	45.6
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In a plastic test on the same soil, the water content was 23.9 % and 24.3%.
Classify the soil according to British classification system.

(8 Marks)

(c) Given that a soil sample has a water content of 12%, specific gravity value of 1.87 for the soil mass and specific gravity value of 2.68 for the solid particles, determine the following:

- (i) Void ratio
- (ii) Degree of saturation
- (iii) Porosity

(9 Marks)

(d) Discuss the design of filters for quicksand conditions.

(5 Marks)

Answer any TWO questions

Question TWO (20 Marks)

(a) Table 2 shows the results of a proctor compaction test.

- (i) Plot the compaction curve and determine the compaction parameters.
- (ii) Determine the moisture content necessary for complete saturation at the maximum dry density if the specific gravity of the solids is 2.72.
- (iii) Plot the 'zero air voids' line

TABLE 2

Bulk Density (kg/m ³)	2057	2141	2151	2158	2139
Moisture content (%)	12.8	15.0	15.6	16.8	17.8

(14 Marks)

(b) Derive an expression for dry density in terms of density of water, particle specific gravity, air content, void ratio and moisture content.

(6 Marks)

Question THREE (20 Marks)

(a) A pumping test was carried out for determining coefficient of permeability of soil in place. A well of diameter 40 cm was drilled up to impermeable stratum. The depth of the water bearing stratum was 8 m. The yield from the well was 4 m³/min at a steady draw-down of 4.5 m. Determine the coefficient of permeability in m/day if the observed radius of influence was 150 m.

(6 Marks)

(b) A sheet pile wall is driven to a depth of 6 m into permeable soil extending to a depth of 13.5 m below the ground level. Below this depth is an impermeable stratum. If the depth of water is 4.5 m on one side of the sheet pile wall, make a neat sketch of the flow net and determine

the approximate seepage under the sheet pile wall in m/day. Take permeability of the soil as 6×10^{-3} mm/s.

(14 Marks)

Question FOUR (20 Marks)

- (a) The results of a particle-size distribution test on a soil are shown in table 2. Plot the grading curve and classify the soil. Find also the effective size, coefficient of uniformity and coefficient of curvature. Use the particle size distribution chart.

TABLE 2

Sieve Size (mm)	Mass retained (g)
63	100
20	76
6.3	65
2	59
0.6	54
0.212	47
0.063	34
0.020	23
0.006	14
0.002	7

(15 Marks)

- (b) Describe TWO methods of rapid determination of consistency limits.

(5 Marks)

Question FIVE (20 Marks)

- (a) (i) A layer of saturated clay 4 m thick is overlain by sand 5 m deep, the water table being 3 m below the surface. The saturated unit weights of the clay and sand are 19 kN/m^3 and 20 kN/m^3 respectively: above the water table the unit weight of sand is 17 kN/m^3 . Plot the values of total vertical stress and effective vertical stress against depth.

- (ii) If sand to a height of 1 m above the water table is saturated with capillary water, how are the above stresses affected?

(13 Marks)

- (b) (i) Discuss the difference between confined and unconfined ground water conditions.

- (ii) Outline the procedure for carrying out pumping test. (7 Marks)