THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering & Technology

DEPARTMENT OF CIVIL AND BUILDING ENGINEERING

HIGHER DIPLOMA IN BUILDING AND CIVIL ENGINEERING
(HD BC 08A)

END OF SEMESTER EXAMINATIONS

APRIL/MAY 2010 SERIES

HYDRAULICS, GEOLOGY AND SOIL MECHANICS

TIME: 3 HOURS

Instructions to Candidates

You should have the following for this examination:

Answer booklet
Calculator/Mathematical Tables

- This paper consists of **EIGHT** Questions in **TWO** Sections **A** and **B**.
- Answer **FIVE** Questions choosing at least **TWO** Questions from each Section.
- All questions carry equal marks.
- Maximum marks for each part of a question are as shown.

SECTION A : WATER SUPPLY AND WASTE WATER

Question ONE

(a). Sketch the following;

(i). Submerged crib intake
(ii). Canal Intake

(6 Marks)

(b). With the aid of a sketch, explain the chemical sedimentation process in water treatment. **(12 Marks)**

(c). Define the following;

(i). Post chlorination
(ii). Flocculation

(2 Marks)

Question TWO

(a). With the aid of a line diagram outline the conventional process of sewage treatment. **(12 Marks)**

(b). Differentiate the following:

(i). Combined system from separate system.
(ii). Effluent from sludge.
(iii). French drains from lagoons.
(iv). Tertiary treatment from pre-chlorination

(8 Marks)

Question THREE

(a). A venturimeter is installed in a horizontal pipeline of 30cm diameter. The difference of pressure at entrance and throat, read by a mercury manometer is 5cm; when the water is flowing at a rate of 50l/s. The coefficient of discharge cd=0.96. Find the diameter of the throat. **(8 marks)**

(b). A trapezoidal notch with a 30cm base has sides inclined at 30^{o} to the vertical. If the head causing flow is 16cm and cd=0.62, find the discharge. **(3 marks)**

(c). A circular channel of 3m diameter has a slope of 1:500. Chezy's C=50. Calculate the:

(i). Max discharge
(ii). Max velocity **(9 Marks)**

Question FOUR

(a). Two reservoirs with their water level having a difference of 48m are connected by a pipe 3km long and 1.5m diameter. To increase the system, a loop line 1m dia and 1km long is connected to the last 1km of the pipeline. Calculate the increase in discharge due to the addition of the loop $f = 0.008$. **(10 Marks)**

(b). Briefly describe the hydrologic cycle. **(6 Marks)**

(c). Sketch, label and show all the important dimensions of a USWB class A pan. **(4 Marks)**

SECTION B: GEOLOGY AND SOIL MECHANICS

(Answer at least **TWO** Questions from this Section)

Question FIVE

(a). Referring to the given geological map (fig.A)

(i). Draw and label all strike lines
(ii). Draw a topographical section from X-Y
(iii). Find Dip and Strike of the beds
(iv). Write a brief geological History of the site **(15 Marks)**

(b). Differentiate between the following:

(i). Normal and Reverse fault
(ii). Crystal and mineral
(iii). Streak and Lustre
(iv). Cleavage and parting
(v). Porphyritic and Granoblastic **(5 Marks)**

Question SIX

(a). A footing 3m square is to be located at a depth of 1.5m in a sand deposit, the water table being 3.5m below the surface. Values of standard penetration resistance were determined as detailed in Table 1. Determine the allowable bearing capacity. Take $\gamma = 17N/m^3$ and $\gamma^1 = 10KN/m^3$. Use figure 2 and 3.

Table 1

Depth (m)	N
0.75	8
1.55	7
2.30	9
3.00	13
3.70	12
4.45	16
5.20	20

(10 Marks)

(b). A shear box test gave the following results:

Table 2

Vertical Load (kg)	Divisions of proving ring dial gauge (one division to 1).
36.8	16
73.6	26
110.4	35
147.2	44

If the shear box is 60mm square and the proving ring constant 20Nμm, determine the apparent cohesion and the angle of internal friction for the soil. **(10 Marks)**

Question SEVEN

(a). A laboratory test was carried out on a soil sample of specific gravity 2.65 and volume 0.01m^3. The following results were obtained:

Mass of wet soil = 20.6kg
Mass of oven dried soil = 17.0kg

Calculate:-

(i). Saturated density of the sample
(ii). Porosity
(iii). Void ratio
(iv). Degree of saturation
(v). Critical hydraulic gradient **(10½ Marks)**

(b). A sheetpile wall is driven to a depth of 6m in permeable soil, extending to a depth of 14m below the ground level. Below this depth is an impermeable stratum. If the depth of water is 4.5m on one side of the sheet pile wall, make a neat sketch of the flow net and determine the seepage under the sheetpile wall in litres per day. Take permeability of the soil as 7.5 x 10^{-3}mm/s. **(9½ Marks)**

Question EIGHT

(a). State **SIX** assumptions made in Terzaghi's theory of One-dimensional consolidation. **(6 Marks)**

(b). Fig. 1 refers to a retaining wall. Determine the following:

(i). The shear force in KN at the base of the wall so as to prevent its movement away from the backfill.

(ii). The height of total horizontal thrust above the base. **(14 Marks)**

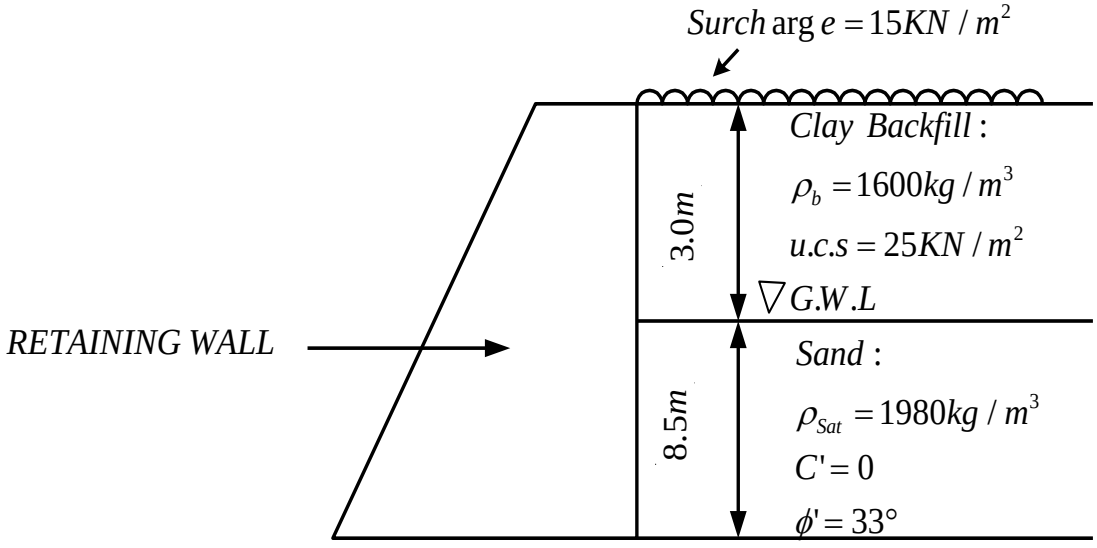

Fig. 1