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 COURSE 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). State **SIX** factors to consider when designing for a water supply for a community. **(6 Marks)**

(b). With the aid of a sketch explain the working principle of a slow sand filter. **(8 Marks)**

(c). Define the following terms:

(i). Filtration
(ii). Flocculation
(iii). Breakpoint chlorination
(iv). Pre – Chlorination
(v). Intake structure
(v). Sedimentation **(6 Marks)**

Question TWO

(a). With the aid of a sketch, explain the working principle of a biological filter. **(10 Marks)**

(b). With the aid of a sketch, explain the working principle of a sedimentation tank in sewage treatment. **(10 Marks)**

HYDRAULICS/HYDROLOGY

Question THREE

(a). A venturimeter of 80mm throat diameter is fitted in a 160mm diameter vertical pipe in which a liquid of unit specific gravity flows downwards. Pressure gauges are fitted to the inlet and throat sections, the throat being 1m below the inlet. The coefficient of the meter is 0.97. Find the discharge if the pressure gauges read the same. **(6 Marks)**

(b). Derive an equation for the actual discharge through a V-notch when the apex angle is 2θ. **(9 Marks)**

(c). Figure 1 shows a roadside gutter whose one side is vertical and the other side inclined at an angle of 60^{o}. If it is laid at a slope of 1:260, determine the flow in m^3/s when the water depth is 380mm. Take manning's n = 0.014. **(15 Marks)**

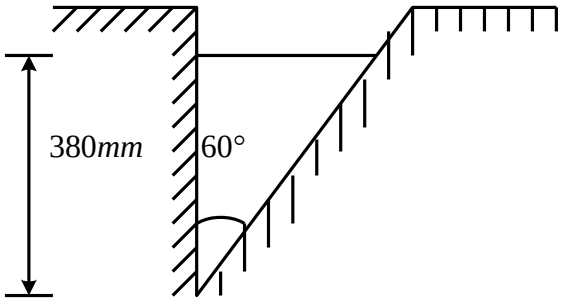

Fig. 1

Question FOUR

(a). The run off from a catchment area is estimated to be 272160m^3 per day. A single circular channel is to be designed. If chezys C = 52 and assuming the slope of the channel as 0.05%, determine the diameter of the channel that gives maximum velocity. **(8 Marks)**

(b). A large reservoir discharges into the atmosphere as shown in fig. 2. Darcy's f = 0.008 for both pipes. Calculate the discharge through the pipe, considering all losses.

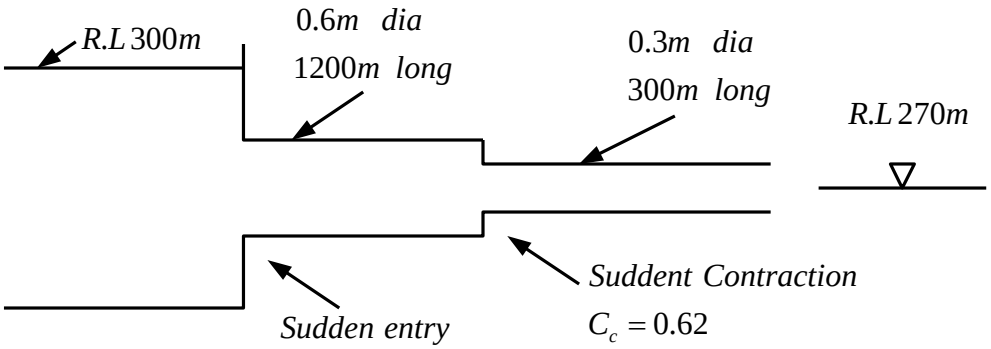

Fig. 2

(8 Marks)

(c). Sketch and label a standard rain gauge showing all salient dimensions. **(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 s detailed in Table 1. Determine the allowable bearing capacity. Take $\gamma = 17N/m^3$ and $\gamma = 10KN/m^3$. 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 20Nbum, 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 7.5×10^{-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)

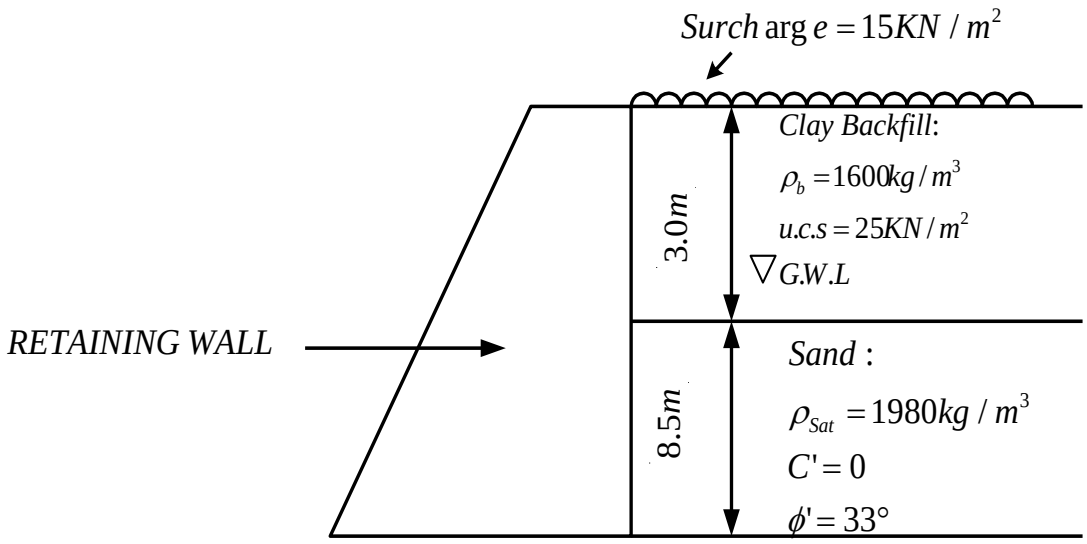
Surch arg e = 15KN / m²
Clay Backfill:
ρb = 1600kg / m³
u.c.s = 25KN / m²
G.W.L
3.0m
RETAINING WALL
Sand :
ρSat = 1980kg / m³
C' = 0
ϕ' = 33°
8.5m

Fig. 1