# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

**((A Constituent College of JKUAT)**

(A Centre of Excellence)

# Faculty of Engineering & Technology in Conjunction with Kenya Institute of Highways and Building & Technology (KIHBT)

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**HIGHER DIPLOMA BUILDING & CIVIL ECONOMICS**

EBE 3118: HYDRAULICS II

**END OF SEMESTER EXAMINATION**
**SERIES:** DECEMBER 2012
**TIME:** 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

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

**Question One (20 Marks)**

**a)** With the aid of a sketch briefly describe "the hydrologic cycle" **(10 marks)**

**b)** Define the following forms of precipitation
- **(i)** Rainfall
- **(ii)** Snow
- **(iii)** Hail
- **(iv)** Smog
- **(v)** Drizzle **(10 marks)**

**Question Two (20 marks)**

a) Make a labeled diagram of a standard raingauge. **(6 marks)**

b) While determining the average precipitation for a certain catchment, thiessen polygons were constructed for a network of eight gauges and the resulting data are shown in table 1.

Determine the average precipitation using:
(i) Arithmetic mean method
(ii) Thiessen polygon method **(14 marks)**

| Station | Precipitation (mm) | Area in $km^2$ of Thiessen Polygon |
|---|---|---|
| A | 40 | 4.2 |
| B | 25 | 10.4 |
| C | 37 | 49.8 |
| D | 49 | 35.8 |
| E | 55 | 6.6 |
| F | 38 | 47.2 |
| G | 48 | 41.5 |
| H | 40 | 1.5 |

**Table 1**

**Question Three (20 marks)**

**a)** Briefly describe the following types of streams:
- **(i)** Perennial streams
- **(ii)** Intermittent streams
- **(iii)** Ephemeral streams **(9 marks)**

**b)** (i) Define the term runoff and state typical units of measurements.

(ii) State **EIGHT** factors that affect the amount of runoff from a catchment area. **(11 marks)**

**Question Four (20 marks)**

a) The data in table 2 was obtained during a stream flow measurement exercise. Using the mid section method, calculate:
   (i) The stream flow
   (ii) The mean velocity of flow **(14 marks)**

| **Distance from left water edge (m)** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **Depth of vertical (m)** | 0.00 | 1.25 | 2.00 | 3.00 | 2.50 | 2.00 | 1.50 | 0.00 |
| **Mean Velocity in Vertical m/s** | 0.00 | 0.40 | 0.63 | 0.80 | 0.68 | 0.65 | 0.55 | 0.00 |

**Table 2**

b) The depth of flow at a vertical in a stream is 3.5m. The velocity of flow at various points in the vertical as measured by a current meter are given in table 3. Determine the mean velocity for the vertical using:

| **Position of meter below water surface (m)** | 0.7 | 1.4 | 2.1 | 2.8 |
|---|---|---|---|---|
| **Velocity m/s** | 3.28 | 3.16 | 2.94 | 2.62 |

**Table 3**

   (i) Single point method
   (ii) Two point method
   (iii) Three point method **(6 marks)**

**Question Five (20 marks)**

**a)** With the aid of a sketch, illustrate the following:
   **(i)** Unconfined aquifer
   **(ii)** Water table
   **(iii)** Confined aquifer
   **(iv)** Perched aquifer
   **(v)** Artesian well **(10 marks)**

**b)** In an artesian aquifer 8m thick, a 10cm diameter well is pumped at a constant rate of 100l/min. The steady state draw down in two wells located 10m and 50m distances from the centre of the well are 3m and 0.05m respectively. Compute.

$(\tau)$

   **(i)** Transmissitivity of the aquifer in $m^2$/day
   **(ii)** Hydraulic conductivity of the aquifer in m/day (coeff of permeability k) **(10 marks)**