



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBC 3221: HYDROLOGY I

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions in **TWO** sections **A & B**

Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages
SECTION A (COMPULSORY)

Question One (20 marks)

- a) State Darcy's Law. **(4 marks)**
- b) Two observation wells located in a radial line from the pumping well have a 30cm difference in the water surface elevations. The two observation wells are 15m apart. At the observation well closest to pumping well, which is at a distance of 90m, the depth from the water table to bedrocks is 24m.
- Calculate:
- i) Discharge rate from the pumping well if the aquifer is sandy and its hydraulic conductivity is 1.567×10^{-5} m/s. **(6 marks)**
- ii) Specific discharge. **(3 marks)**
- iii) Flow velocity if the porosity of the formation is 30%. **(3 marks)**
- iv) Permeability of the soil if the viscosity of the water is 1.381×10^{-8} pa.s **(4 marks)**

SECTION B (Answer any TWO questions)

Question Two (20 marks)

- a) Define the term Hydrology. **(3 marks)**
- b) Briefly describe the Hydrologic cycle. **(3 marks)**
- c) (i) What is precipitation in Hydrology? **(2 marks)**
(ii) List **FOUR** types of precipitation and briefly describe each of them. **(8 marks)**
- d) (i) What is the instrument used for measuring rainfall and snow? **(2 marks)**
(ii) The instrument in (i) above is found in both plastic and metallic types. What is the size (in mm) of each? **(2 marks)**

Question Three (20 marks)

- a) Define surface run off. **(2 marks)**
- b) List the **FOUR** types of runoff and explain for each case how it happens. **(12 marks)**
- c) (i) Explain how urbanization affects surface runoff. **(3 marks)**
(ii) What is the resultant effect of (i) above to the water table. **(3 marks)**

Question Four (20 marks)

- a) Briefly explain how a bucket and a stopwatch can be used as an analogy for the operation of a positive displacement meter? **(2 marks)**
- b) Briefly explain the principle used to operate the following mechanical flow meters.
- i) Piston meter **(2 marks)**
 - ii) Helical gear meter. **(2m arks)**
 - iii) Nutating dibble meter. **(2 marks)**
- c) To calibrate a flow meter, the transit time method was used. A radio tracer was injected in a pipe before radiation detectors placed outside the pipe. The tracer was detected after 10 seconds.
- Calculate the reference flow value in liters/sec that will be compared to the meter reading to be calibrated if the diameter of the pipe is 3 inches. **(6 marks)**
- d) (i) What is a rating curve in hydrology? **(3 marks)**
(ii) Briefly explain what a break point is in a rating curve. **(3 marks)**

Question Five (20 marks)

- a) Briefly describe the following types of drilling machines used for drilling water wells. **(4 marks)**
- b) What are the **TWO** types of casing used for the drilling wells? **(2 marks)**
- c) Define the following terms in hydrology.
- i) Aquifer
 - ii) Aquitard
 - iii) Aquidude
 - iv) Aquifuge **(4 marks)**
- d) Drilled water wells can be classified into two categories:
- i) The first category is based on the type of aquifer the well is in. List the **TWO** types of drilled water in this category and briefly describe each one of them. **(4 marks)**
 - ii) The second category of drilled well types is based on the use of the well. List **TWO** types of wells in this category and briefly describe each of them. **(4 marks)**
- e) What factors are considered when citing a water well? **(2 marks)**