# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2305 : PUBLIC HEALTH ENGINEERING I

END OF SEMESTER EXAMINATION

**SERIES:** DECEMBER 2016

**TIME:** 2 HOURS

**DATE:** 15 Dec 2016

**Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

*-Drawing instruments.*

This paper consists of five questions.

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

**Do not write on the question paper.**

**QUESTION 1**

a) Describe briefly four types of water intakes. Use neat sketches to illustrate you answer. **(8 Marks)**
b) Discuss three methods used to determine the average runoff from a catchment area clearly describing how the amount of runoff will be arrived at. **(6 Marks)**
c) State the role of the following processes in water treatment:
   i. Screening
   ii. sedimentation
   iii. Disinfection
   **(6 Marks)**
d) A 400mm diameter well which fully penetrates a 30m thick confined aquifer, is being pumped at a constant rate of $0.96m^3$/min producing drawdowns of 1.2m and 0.6m in two test wells 24m and 54m away respectively from the pumping well. Determine the drawdown in the pumped well. **(10 Marks)**

**QUESTION 2**

a) List five possible inorganic contaminants in water and state their health or aesthetic significance in drinking water. **(5 Marks)**
b) What is the purpose of treating water for public water supply? **(3 Marks)**
c) Discuss the merits and demerits of a surface ware source and a surface water source for water supply to a town. **(5 Marks)**
d) Consider a sedimentation tank of length L, breadth B, depth D and flow rate Q. If the particle that enters at the top of the tank and settles at the bottom of the tank just before the water leaves the tank has a vertical settling velocity of $V_p$, using a sketch show that the sedimentation of particles do not depend on the depth of the tank but the surface area of the tank. **(7 Marks)**

**QUESTION 3**

a) Filtration is a very important process in water treatment. Explain its purpose and describe the main components a typical filter unit. **(6 Marks).**
b) Define the terms "effective size" and "uniformity coefficient" of a filter media. **(4 Marks)**
c) A small town in Kenya has no piped water. The County government is planning to supply water to this town. Its population was 20,000 people in the 2009 population census. The population of the town is projected to grow at a constant rate of 3.0% from 2009 to 2050. If the "initial" year is 2020, calculate the water demand of the town in the initial, future and ultimate years respectively. Assume uniform water consumption per capita of100 l/h/d.

The local water engineer has recommended slow sand filters to be used in the treatment of water. Calculate the surface area of the filters required to treat the ultimate requirements for the community. Assume a filtration rate of 0.15 $m^3/h/m^2$.
**(10 Marks)**

**QUESTION 4**

a) Explain the following terms using neat sketches where applicable.
   i. Turbidity
   ii. Jar test
   iii. Break-point chlorination **(6 Marks)**
b) Differentiate between temporary and permanent water hardness. **(2 Marks)**
c) A waterworks is intended to serve a city with a population of 600,000 people. The average water consumption per capita is 120l/h/d. Aluminium sulphate (Alum) has been recommended for use as a coagulant. Jar test conducted in the laboratory shows optimum dose of 4mg/l. calculate the quantity of Alum required per day in kilograms. **(8 Marks)**
d) During design of a water supply system, a gravity system is preferred over a pumping system. Explain why this preference. **(4 Marks)**

**QUESTION 5**

a) Discuss the disadvantages of conveying water in open channels for public water supply. **(4 marks)**
b) Water pipes are made of various materials such as steel, plastic, concrete and others. Treated water is almost exclusively conveyed through pipelines laid underground. What are the factors which are considered in choosing the appropriate pipe material? **(4 marks)**
c) When laying of a new water pipeline is completed, it is mandatory to test for its soundness. This is to ensure that it has been properly laid according to the specifications and that it can withstand the expected water pressures. Outline the procedure of testing a new water pipeline. **(6 marks)**
d) Water is to be supplied to a town with a population of 100,000. The waterworks is situated at a lower level than the water intake with a level difference of 48 metres. Determine the size of the gravity main of length 30km if the per capita water consumption is 150l/h/d. Take friction factor in the pipe to be 0.060 and the system operates for 24 hours in a day. **(6 Marks)**