TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2305: **PUBLIC HEALTH ENGINEERING I**

END OF SEMESTER EXAMINATION

SERIES:APRIL2016

TIME:2HOURS

DATE:18May2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

ANSWER **THREE** QUESTIONS. QUESTION **ONE** IS COMPULSORY.

QUESTION 1:

a) Define the following terms as used in water supply engineering:

1) Water demand projection
2) Average water demand
3) Variation in water demand
4) Water consumption per capita

(8 Marks)

b) What are the main water uses considered during water demand projection for public water supplies? **(3 Marks)**
c) State five waterborne diseases and the pathogenic bacteria/microorganism causing each of the diseases mentioned. **(5 Marks)**
d) What is the function(s) of the following units in a water treatment plant:
   i. Screens
   ii. Sedimentation tank
   iii. Filters

(6 Marks)

e) Differentiate between plain and chemical assisted sedimentation as applied in water treatment. **(2 Marks)**
f) A tourist town in Kenya is experiencing chronic water shortages which have affected most businesses including hotels. One of the high class hotels is contemplating putting up its own water supply. If the hotel has a bed capacity of 600 beds, calculate its water demand. Use the table provided for water consumption rates. **(6 Marks)**

QUESTION 2:

a. Filtration is a very important process in water treatment. 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 rural community in Kenya has no piped water. The government is planning to supply water to this community. Its population was 10,000 people in the 2009 population census. The population of the community is projected to grow at a constant rate of 2.5% from 2009 to 2050. If the "initial" year is 2018, calculate the water demand of the community in the initial, future and ultimate years respectively. Assume uniform water consumption per capita of 30 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 3:

a) Explain the following terms using neat sketches where applicable.
   i. Water hardness
   ii. Break-point chlorination
   iii. dechlorination

(6 Marks)

b) Differentiate between temporary and permanent water hardness. **(2 Marks)**

c) During design of a water supply system, a gravity system is preferred over a pumping system. Explain why this preference. **(4 Marks)**

d) A waterworks is intended to serve a city with a population of 400,000 people. The average water consumption per capita is 100l/h/d. Aluminium sulphate (Alum) has been recommended for use as a coagulant. Jar test conducted in the laboratory shows optimum dose of 5mg/l. calculate the quantity of Alum required per day in kilograms. **(8 Marks)**

QUESTION 4:

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 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 60 metres. Determine the size of the gravity main of length 20km if the per capita water consumption is 120l/h/d. Take friction factor in the pipe to be o.075 and the system operates for 12 hours in a day. **(6 Marks)**

Consumption Rates

CONSUMER	UNIT	RURAL AREAS			URBAN AREAS		
		High potential	Medium potential	Low potential	High Class Housing	Medium Class Housing	Low Class Housing
People with individual connections	l/head/ day	60	50	40	250	150	75
People without connections	l/head/ day	20	15	10	-	-	20
Livestock unit	l/head/ day	50			-		
Boarding schools	l/head/ day	50					
Day schools with WC without WC	l/head/ day	25 5					
Hospitals Regional District other	l/bed/ day	400 200 100			+ 20 l per outpatient and day (minimum 5000 l/day)		
Dispensary and Health Centre	l/day	5000					
Hotels High Class Medium Class Low Class	l/bed/ day	600 300 50					
Administrative offices	l/head/ day	25					
Bars	l/day	500					
Shops	l/day	100					
Unspecified industry	l/ha/day				20,000		
Coffee pulping factories	l/kg coffee	25 (when re-circulation of water is used).					