THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

University Examination 2010

THIRD YEAR/FIRST SEMESTER EXAMINATION
FOR THE DEGREE IN BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2305: PUBLIC HEALTH ENGINEERING

SERIES: APRIL/MAY 2010 **TIME:** 2 HOURS

Instructions:

Answer Question **ONE** and any other **TWO** questions.

QUESTION ONE

(a) Define the following water demand projection terms with respect to the preliminary design year:

(i) Initial year
(ii) Future year
(iii) Ultimate year (6 marks)

(b) State **THREE** sources of population growth rate data in Kenya. (6 marks)

(c) Calculate the ultimate water demand (in M^3/day) for a town in Kenya with the following National census data conducted in 1980. (4 marks)

Make the following assumptions:

(i) The preliminary design was done in 1980.
(ii) The population growth rate was 7.5% per annum.
(iii) The general economy growth rate was 7.5%l per annum.

Demand Type	Census Data (1980	Water use rate
1. Urban population	635,000	62 litres/head/day
2. Boarding schools	90,000 students	50 litres/head/day
3. Day schools	65,000 students	25 litres/head/day
4. Town hospitals		
Inpatients beds	40	400 litres/head/day
Outpatients	120 per day	20 litres/head/day
5. Industries	3	20,000 litres/day

QUESTION TWO

(a)   State the **THREE** key decision making considerations for drinking
        water chlorination.   (3 marks)

(b)   Name **TWO** common drinking water chlorine based chemicals used
        in most developing countries.   (4 marks)

(c)   A rural water supply system has the following data:

- Water supply demand of 20,000 m^3/day.
- Water storage tank (also used for chlorination) volume of
  300m^3.

(i)   Determine the effective chlorination contact time (in minutes).
(ii)   Discuss the chlorination effectiveness and suggest improvements.
                                                                    (16 marks)

QUESTION THREE

(a)   Define the following terms with respect to water flow in closed conduits.

(i)   Frictional head loss
(ii)   Hydraulic gradient
(iii)   Velocity head   (6 marks)

(b)   State the following equations (and describe all the parameters) for
        calculating the frictional head loss in pipes:

(i)   Darcy-Weisbach equation
(ii)   Hazen-Williams equation.   (7 marks)

(c)   Calculate the frictional head loss (using the Hazen-Williams equation)
        for a water supply pipeline of the following data:

(i)   Flow velocity = 1.6m/s
(ii)   Nominal pipe diameter = 200mm
(iii)   Pipeline length = 1000m
(iv)   Hazen-Williams coefficient = 132   (10 marks)

QUESTION FOUR

(a)   by use of a simplified diagram, illustrate the concept of the hydrologic water cycle.   (8 marks)

(b)   State the mass balance equation for the water budget.   (3 marks)

(c)   Define the following terms:

    (i)   Aquifer
    (ii)   Safe yield of an aquifer.   (2 marks)

(d)   Describe the logical methodology to determine whether the ground water flow in an aquifer is laminar or not.   (10 marks)

QUESTION FIVE

(a)   State the **THREE** factors that influence the transmission of waterborne diseases.   (3 marks)

(b)   Name the group of bacteria that is normally used as an indicator of microbiological water quality.   (2 marks)

(c)   Name **FIVE** parameters of chemical quality of drinking water.   (5 marks)

(d)   Define the following terms:

    (i)   Turbidity
    (ii)   Total Maximum Daily Load (TMDL) of a pollutant
    (iii)   BOD
    (iv)   COD   (4 marks)

(e)   Calculate the BOD_5 for the following water sample:

The BOD test for the water was set up by pipetting 5ml into each 300ml bottles. For one pair of bottles, the test results were as follows: The initial dissolved oxygen (DO) was 7.5mg/l, and after 5 days of incubation at 20°C the final DO was 2.9mg/l. (Assume no BOD is associated with the dilution water.)