TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2313: PUBLIC HEALTH ENGINEERING II

END OF SEMESTER EXAMINATION

SERIES: APRIL2016

TIME: 2HOURS

DATE: 13May2016

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 1 IS COMPULSORY.***

QUESTION 1:

a) Define the following terms as used in wastewater engineering:

i. Wastewater
ii. Chemical Oxygen Demand (COD)
iii. Biochemical Oxygen Demand (BOD)
iv. Domestic sewage

(8 Marks)

b) Differentiate between aerobic and anaerobic reactions as applied in wastewater treatment stating clearly the end products of each of these reactions. **(6 Marks)**

c) What are the goals of waste water treatment? **(3 Marks)**

d) List and explain the factors that determine the quantity of sewage generated by a community. **(5 Marks)**

e) An estate in a certain city has been experiencing stormwater drainage problems. The City Authority is in the process of planning a combined sewerage system. The total area of the catchment of the estate is 30 hectares with a runoff coefficient of 40%. The time of concentration, t, of the catchment is 21 minutes and the formula for calculating rainfall intensity cm/h, R=101.2/(t+20). Using the rational formula, calculate the maximum stormwater discharge for which the sewer must be designed. **(8 Marks)**

QUESTION 2:

a. Briefly describe the following terms as used in sewage flow:
   i. Variation in sewage flow
   ii. Average flow of sewage
   iii. Design flow of sewage

(6 Marks)

b. Differentiate between carbonaceous Oxygen Demand and Nitrification Oxygen Demand. Use a sketch to illustrate your answer. **(4 Marks)**

c. Design a trickling filter unit for wastewater treatment for a town with a population of 40,000 people. The expected dry weather sewage flow (DWF) is 150l/person/day and a volumetric loading of 600 litres/m^3 of filter media. **(8 Marks)**
State the factors which affect volumetric loading of trickling filters. **(2 Marks)**

QUESTION 3:

a. Describe briefly the biological treatment of wastewater. **(4 Marks)**

b. State the function(s) of the following units in activated sludge process:
   i. Primary treatment units **(2 Marks)**
   ii. Aeration tank **(2 Marks)**
   iii. Secondary settling tank **(2 Marks)**
   iv. Sludge return line **(2 Marks)**

c. Design a secondary settling tank for activated sludge process for a town with a peak sewage flow of 6,000m^3/day. Assume a detention period of two hours with a recirculation flow of 30%. **(8 Marks)**

QUESTION 4:

a. What are waste stabilization ponds? State the principle behind their utilization in wastewater treatment. **(4 Marks)**
b. Briefly describe the limitations of using waste stabilization ponds as a wastewater treatment method. **(3 Marks)**
c. What is the major purpose of maturation ponds in a waste stabilization pond system? Outline the design procedure used for maturation ponds. **(5 Marks)**
d. A consultant has proposed a waste stabilization pond system for treatment of wastewater in a town. The system consists of one anaerobic pond with retention time of three days; one facultative pond with retention time of three days and two identical maturation ponds with retention time of five days each. All the ponds are in series. The Environmental Authority requires that the effluent from maturation ponds have a maximum fecal coliform count of 5,000 per 100ml. If the influent coliform count is $4x10^7$ per 100ml of sewage; confirm whether this requirement has been met in the consultant's proposed pond system. If this requirement has not been met, propose what should be done in order to comply with this requirement. Assume a constant for fecal coliform die-off, $K_2 = 2.0$. **(8 Marks)**