TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2512: PUBLIC HEALTH ENGINEERING IV

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2013
TIME ALLOWED: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions. Answer question **ONE (Compulsory)** and any **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **TWO** printed pages

Question One (Compulsory)

a) Discuss how each of the following discharges contribute to water pollution:
   (i)   Toxic compounds
   (ii) Pathogens
   (iii) Oils and greases
   (iv) Heated discharges
   (v)   Inert suspended solids

b) Differentiate between a dry well and wet well pumping station and the advantages of either.

c) Discuss why sewage pumping may be included in the design and management of a sewerage system.

d) What are the TWO approaches in setting standards for pollution control of a river? What information do you need for setting the standards?

e) What is the purpose for wastewater treatment?

f) Provide a neat sketch of a typical conventional wastewater treatment plant with an online equalization basin.

Question Two

a) Discuss the circumstances under which the following wastewater management facilities may be provided:
   (i)   Sewers
   (ii) Septic tanks
   (iii) Pit latrines

b) Design a septic tank system with drain field trenches for an apartment block housing 24 people. Make the following assumptions:
   -   water consumption   150l/capita/day
   -   Sludge storage   135l/person
   -   Infiltration rate   10l/min/day
   -   Trench depth   1.2m
   -   Desludging to be done when 50% full

   You may assume any other design parameters

   Illustrate your design with neat sketches.

Question Three

Design a baffle type flocculation mixing basin of round the end type with the following data:

   -   Daily quantity of water to be treated – 12×10^6 litres
   -   Detention period – 20 minutes
   -   Average velocity of flow – 22.5cm/sec

Assume that the basin is divided into two halves by a central longitudinal wall, the width of each half being 3m, and that the clear distance between baffle and end of wall is 1.5 times the distance between baffles.

Question Four

a) List the main steps followed in an economic analysis study of a water supply and sewerage project.

b) A project to develop the water supply infrastructure in Voi is being considered, and four alternatives have been proposed. All the alternatives have a 20 year design life, and projected economic conditions indicate that a 6% interest rate should be used in comparing the alternatives. The details of the alternatives are as follows:

   Alt 1:   Will accrue a lump sum return of USD 100,000 at the end of the first 10 years and a lump sum return of USD 200,000 at the end of the second 10 years

   Alt 2:   Will yield annual returns of USD 15,000 for all the 20 years of the project

   Alt 3:   Will yield a return of USD 6,000 at the end of the first year, and the return increases by USD 1,000 per year in subsequent years.

Alt 4: Will yield a return of USD 6,000 at the end of the first year, and the returns are projected to increase by 8% per year in subsequent years.

Determine the equivalent present worth for each alternative. If all the alternatives have approximately the same cost, which one will provide the greatest return on investment?

Question Five

a) List the factors that influence sedimentation in water treatment.

b) What are the essential characteristics of a good disinfectant for water supply?

c) List the reasons why chlorine (and its compound) is widely used for disinfection of water.

d) Determine the size of a rectangular tank to treat 1.8×10^6 litres of raw water per day if the detention period is assumed to be 4 hours and the over flow rate is less than 50,000 l/m2 of the surface area per day.