UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

B.Sc. Degree Programs in Environmental Health

SUPPLEMENTARY EXAMINATION PAPER JULY 2013

TITLE OF PAPER : URBAN WATER TREATMENT

COURSE CODE : EHM 208

DURATION : 2 HOURS

MARKS : 100

INSTRUCTIONS : THERE ARE FIVE QUESTIONS IN THIS EXAM.

: ANSWER ANY FOUR OUT OF THE FIVE THE QUESTIONS

: EACH QUESTION CARRIES A MAXIMUM MARK OF 25%

: NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE EXAMINATION ROOM

Question One (25 Marks)

A) What side effects do algae bring if found in water? What are the factors that contribute to algal bloom in water? .. ..[9 Marks]

B) Indicate whether each of the following statements is true or false about temperature increase. Explain the reason for your answer in each case.

(i) Reduces the solubility of Calcium carbonate in water

(ii) Reduces the rate of sedimentation of solids

(iii) Increases the rate of disinfection by chlorine. .....[8 Marks]

C) Indicate whether each of the following statements is true or false about settlement of flocculent particles. Explain the reason for your answer in each case.

i) The density of flocs is greater than that of individual particles of clay from which flocs are formed.

ii) Increasing the floc radius will decrease their buoyant density.

iii) The rate of settlement of flocs is dependent on the depth of tank.

iv) Lower G values result in larger floc radius and hence are preferred to higher G values.....[8Marks]

Question Two (25 Marks)

A) Indicate whether each of the following statements is true or false about rapid sand filters. Explain the reason for your answer in each case.

i) Biological mechanisms are not important in rapid sand filters.

ii) Straining is the dominant mechanism of particle removal.

ii) Removal of particles occurs over a considerable depth.

iv) The medium must be cleaned by back washing with water and possibly assisted by air

.....[8 Marks]

B) Sketch a diagram of an intake in the form of infiltration gallery.....[8 Marks]

C) Describe tilted plate or tube settlers and the advantages they have compared to horizontal flow sedimentation tanks. .....[9 marks]

Question Three (25 Marks)

A rectangular sedimentation tank is to be designed to handle a flow of 1 m^3/sec. A number of tanks are to be provided in parallel. The surface loading rate in each tank is to be 12 m^3/m^2.day. Use a side water depth of 4 meters. For calculation of scour velocity assume k= 0.05, specific gravity = 2.6 and friction factor f= 0.025.

A. Determine the number of tanks operating in parallel assuming that when one tank is taken out for cleaning and maintenance each of the other tanks should carry extra discharge not more than 30% of what they carry when all tanks are in operation

...[7 Marks]

B. Determine the length, volume and detention time of the rectangular sedimentation tanks assuming that the minimum length to width ratio (L:W) of each of the individual tanks is 4:1. .....[10 marks]

C. Calculate the scour velocity and determine if settled material will become resuspended or not. .....[8 marks]

Question Four (25 Marks)

A) Name three types of chemicals commonly used for the coagulation of water

.....[8 Marks]

B) Explain the relationship between coagulation potential and pH for the different types of coagulating chemicals you mentioned in question2A above. List also the chemicals that can be used to adjust the pH. .....[9 Marks

C) Indicate whether each of the following statements is true or false about declining rate filters. Explain the reason for your answer in each case.

i) Declining rate filtration allows a high filtration rate when the sand is clean and lower filtration rate when the bed is loaded with deposits.

ii) The water level in all the filters is not the same.

iii) The filter works by itself leaving no room for operational maneuvering or the possibility of operational abuse.....[8 Marks]

Question Five (25 Marks)

A) Name the following four compounds of chlorine that contain:

i) 99% chlorine by weight

ii) 5-16% chlorine by weight

iii) 35% chlorine by weight

iv) 70% chlorine by weight.....[6 Marks]

B) State two advantages and two disadvantages of using ozone for disinfection of drinking water.....[7 Marks]

C) List the following disinfecting compounds in order of decreasing oxidation potential:

i) Chlorine ii) Ozone iii) Chlorine dioxide iv) Iodine.....[6 Marks]

D) Name three common methods of sterilization (disinfection) of water intended for human consumption.....:.....[6 Marks]