



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE

SET 426: WASTEWATER TREATMENT AND REUSE 1

DATE: Thursday 1st December 2011

TIME: 2.00p.m – 4.00p.m

INSTRUCTIONS:

This paper contains FIVE questions. Attempt THREE questions only.

Question 1

What is meant by activated sludge? Describe with sketches the treatment of sewage by activated sludge process. Mention the advantages and disadvantages of this system.

(20marks)

Question 2

(a) Describe the principles involved in the design and construction of:

(i) Septic tanks

(ii) Imhoff tanks

(10marks)

(b) Wastewater is flowing at 4.5 million litres per day from a primary clarifier to a standard rate trickling filter. The 5-day BOD of the influent is 60mg/l. The organic loading and surface loading for the wastewater are $160\text{g/m}^3\cdot\text{day}$ and $200\text{l/m}^2\cdot\text{day}$, respectively.

(i) Determine the volume of the filter and its depth.

(ii) Calculate the efficiency of the filter unit

(10 marks)

Question3

(a) Differentiate between aerobic and anaerobic treatment of wastewater, giving major end products.

(10marks)

(b) A high rate activated sludge plant with an aeration tank of volume 175m^3 has an applied load of 1.5 Mld with an average BOD of 250mg/l and suspended solids of 160mg/l. The mixed liquor in the aeration tank is held at a concentration of 4,000 mg/l of suspended solids. Based on this information, calculate:

(i) BOD loading (kg/ha.m)

- (ii) BOD loading as F/M ratio
- (iii) Aeration period (hrs)
- (iv) Sludge age (days)

(10 marks)

Question 4

- (a) Discuss how a standard rate trickling filter differs from a rate high trickling filter.

(10marks)

- (b) A grit chamber is designed to remove particles with a diameter of 0.2mm and specific gravity 2.65. Settling velocity for these particles is assumed to range from 0.016 to 0.022ms^{-1} , depending on their shape factor. A flow through velocity of 0.3ms^{-1} is maintained by a proportioning weir. Determine the channel dimensions for a maximum wastewater flow of $10,000\text{m}^3/\text{day}$.

Assume the depth of flow is 1m.

(10marks)

Question 5

The contaminants in wastewater are removed by physical, chemical and biological means. Discuss.

(20marks)

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