



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

OPEN, DISTANCE AND E-LEARNING

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

(WATER ENGINEERING)

SET 426: WASTE WATER TREATMENT AND REUSE I

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DATE: SATURDAY 9TH JULY 2011

TIME: 8.00 A.M. – 10.00 AM.

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INSTRUCTIONS

This paper contains FIVE questions. Attempt THREE questions only.

Question 1

- a) Differentiate between aerobic and anaerobic treatment of wastewater, giving major end products. (10 marks)
- 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 160mg/l. The organic loading and surface loading for the wastewater are 160 g/m³ day and 200 l/m². day. respectively.
- i) Determine the volume of the filter and its depth.
- ii) Calculate the efficiency of the filter plant. (10 marks)

Question 2

- a) Discuss the mechanism of working of a stabilization pond. (10 marks)
- b) A single filter is to treat a flow of 3.79 million litres per day of raw wastewater with BOD of 240 mg/l. The design is for a loading of 11086 kg of BOD in the raw wastewater per hectare metre, and recirculation ratio is 1. What will be the strength of the effluent? Assume that 30% of BoD is removed in the primary clarifier.

(10 marks)

Question 3

A town having a population of 30,000 persons is producing the following sewage:

- i) Domestic sewage at 102 litres per caput per day having 200 mg/l of BOD.
- ii) Industrial sewage at 300,000 litres per day having 800 mg/l of BOD.

Design high rate single stage trickling filters for treating the above sewage.

Assume that the primary sedimentation tank removes 35% of BOD. Allow an organic loading of 10,000 kg / ha- day (excluding recirculated sewage) The recirculation ratio is 1.0, and the surface loading should not exceed 170 ML/ha/day (excluding recirculated sewage)

Finally, determine the efficiency of the filter and the BOD of the effluent. (20 marks)

Question 4

- a) Discuss how a standard rate trickling filter differs from a high rate trickling filter. (10 marks)
- b) A grit chamber is designed to remove particles with a diameter of 0.2 mm and specific gravity 2.65. Settling velocity for these particles is assumed to range from 0.016 to 0.022 ms⁻¹, depending on their shape factor. A flow through velocity of 0.3 ms⁻¹ is maintained by a proportioning weir. Determine the channel dimensions for a maximum wastewater flow of 10,000 m³/day. Assume the depth of flow is 1m. (10 marks)

Question 5

- a) Describe the principles involved in the design and construction of:
 - i) Septic tank
 - ii) Imhoff tank (10 marks)
- b) A rectangular sedimentation basin is to be designed for a flow of 4.5 million litres a day using 2:1 length to breadth ratio, an overflow rate of 0.000213 m³s⁻¹ and a detention time of 3 hours. What are the dimensions of the basin? (10 marks)