



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

INSTITUTE OF OPEN LEARNING (IOL)

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (WATER
ENGINEERING)

SET 427: WASTEWATER TREATMENT AND REUSE II

DATE: Saturday, 9th July, 2011

TIME: 4.30 p.m. – 6.30 p.m.

INSTRUCTIONS:

The paper contains **FIVE** questions. Attempt **THREE** questions only.

Question 1

- a) Describe in detail the WHO and FAO guidelines necessary for effluent reuse.
(10 marks)
- b) Discuss how geotechnical and pond geometry considerations form an important aspect of physical design of waste stabilization ponds. (10 marks)

Question 2

- a) In details, describe dilution as a method of sewage disposal stating the conditions necessary for its adoption. (10 marks)
- b) A town disposes sewage by land treatment. It has a sewage farm of area 150 hectares. The area includes an extra provision of 50% for rest and rotation. The population of the town is 50,000 people and the rate of water supply is 140 litres per capita per day. If 75% of the water is converted into sewage, determine the consuming capacity of the soil. (10 marks)

Question 3

- a) Describe in detail the various stages of self-purification in streams stating the characteristics of each. (10 marks)
- b) Two stabilization ponds to treat sewage for a town of 30,000 people are operated in series. The larger pond has an area of $60,000\text{m}^2$ and the smaller one $30,000\text{m}^2$. The average daily waste flow is $900\text{m}^3/\text{day}$ containing 200 kg of BOD.
- i) For series operation, calculate the BOD loadings based on both the total area and the larger pond only.
- ii) Estimate the number of days of storage available between 0.6m and 1.5m water levels, assuming an evaporation and seepage loss of 2.5mm of water per day.

(10 marks)

Question 4

What is the purpose of sludge digestion? Describe the uses and biological process for aerobic and anaerobic digestion. (20 marks)

Question 5

A sewage effluent of 250 cumecs is being discharged from a city into a perennial stream which is fully saturated with oxygen and flows at a minimum rate of 3200 cumecs with a minimum velocity of 0.24ms^{-1} . If the 5 – day BOD of the sewage is 300 mg/l, find where the critical DO will occur in the stream. Assume:

- i) The coefficient of purification of the stream as 4.0
- ii) the ultimate BOD as 125% of the 5 – day BOD of the mixture of sewage and stream water
- iii) Saturation DO of the stream as 9.32 mg/l.

(20 marks)