



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIFTH YEAR SPECIAL/ SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 506: PUBLIC HEALTH ENGINEERING III

DATE: 23/3/2021

TIME: 2.00-4.00 PM

INSTRUCTIONS

(i) ATTEMPT THREE QUESTIONS

(ii) REASONABLE ASSUMPTIONS SHOULD BE MADE WHERE NECESSARY

QUESTION ONE (20 MARKS)

- a) Discuss the main pathways of Biological Oxygen Demand (BOD) removal in biological wastewater treatment (10 marks)
- b) The bulk of suspended solids which enter a wastewater treatment plant and the waste solids generated in biological treatment result into sludge. Discuss the importance of sludge treatment and management in a WWTP. hence list five sludge conditioning processes (10 marks)

QUESTION TWO (20 MARKS)

A primary clarification system is required for a community with an average wastewater flow of $17.5 \times 10^6 \text{ L/day}$, a maximum of $3 \times 10^7 \text{ L/day}$ and a minimum of 10^7 L/day . Use at least 2 basins and a surface overflow rate of 30 m/day at average flow. Using the figure provided determine the efficiency of BOD removal at all flow conditions with all basins working and with one basin out of service. A maximum number of 3 basins should be considered. Only surface area is required for this design

QUESTION THREE (20 MARKS)

Wastewater must first be treated to remove the bulk of contaminants to meet the requirements for disposal consistent with environmental regulations. Disposal can be by reuse, by discharge to surface waters, by injection or percolation to ground waters or by evaporation to the atmosphere. By use of a flow chart discuss the process of wastewater treatment in a conventional treatment system

QUESTION FOUR (20 MARKS)

Developing countries within the tropics undertake wastewater treatment using wastewater stabilization ponds which are also known as lagoons. Why is this the preferred option? Hence discuss the types of ponds based on the type of processes occurring within the ponds

QUESTION FIVE (20 MARKS)

- a) Define solid waste and state the factors that influence its generation? (10 marks)
- b) Any system employed to process solid waste must have the inherent flexibility to cope with its varying character. There are myriad influences of varying intensity that continually alter the quantity, composition, and physical and chemical character of the material. Discuss three purposes of waste characterization (10 marks)