MACHAKOS UNIVERSITY

University Examinations for 2019/2020Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 310: PUBLIC HEALTH ENGINEERING II

DATE: 23/11/2020 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

(i) QUESTION ONE IS COMPULSORY

(ii) ATTEMPT ANY OTHER TWO QUESTIONS

(iii) REASONABLE ASSUMPTIONS SHOULD BE MADE WHERE NECESSARY

QUESTION ONE (COMPULSORY) (30 MARKS)

a) The biological constituents found in domestic wastewater are extremely important, due to the public health considerations involved, which stem from the source and nature of the microorganisms present. Of the microorganisms present in domestic wastewater, bacteria, protozoa, fungi, algae, and viruses are of the greatest significance to the environmental engineer. Briefly discuss the importance of each of the listed categories. (10 marks)

b) Explain the difference between infiltration and inflow to a citizen's group. (5 marks)

c) Explore the reasons as to why industries are required to pretreat wastewater before discharging to municipal sewers (5 marks)

d) Explain why infiltration rates for new sewers are expected to be lower than for old existing sewers. (5 marks)

e) Explain the logic behind the following design criteria with respect to sewers: **minimum pipe size, minimum velocity.** (5 marks)

QUESTION TWO (20 MARKS)

a) Discuss the importance of the following pollutants found in wastewater (10 marks)

i. Temperature

ii. Chromium, Cr

iii. Nitrate, NO

iv. Phosphorous, P

v. Color

b) When biodegradable organic matter is released into a body of water, microorganisms, especially bacteria, feed on the wastes, breaking it down into simpler organic and inorganic substances. The amount of oxygen required to oxidize (break down) organic wastes aerobically is called Biochemical Oxygen Demand (BOD). Using the BOD curve, discuss the oxygen demand for carbonaceous and nitrogenous matter. What are the end products of this process in an environment with enough oxygen? (10 marks)

QUESTION THREE (20 MARKS)

a) Rural areas and the outskirts of urban areas may have insufficient population to support sewer systems and central treatment. This necessitates the construction of wastewater treatment systems for individual houses or institutions. Giving five examples of these systems discuss how they are selected. (10 marks)

b) With the aid of a diagram describe the treatment process in septic tanks. What are some of the operation procedures that must be observed? (10 marks)

QUESTION FOUR (20 MARKS)

a) Distinguish between separate and combined sewers stating the advantages and disadvantages of each. List the materials that are often used for sewers. (10 marks)

b) Determine the velocity of 0.0081 m 3/s flow in a 200 mm diameter sewer at a slope of 0.0040 m/m. The pipe is new VCP with n=0.13 assuming the pipe is flowing almost full. (10 marks)

QUESTION FIVE (20 MARKS)

Determine the size of a sanitary gravity sewer of concrete (n=0.013), square in shape flowing half full and must carry sewage at a uniform rate of flow of $2m^3/s$. **Clearly show your logic behind minimum velocity and minimum sewer size**. Allow a 10% freeboard. What would be the required channel bottom slope for this sewer?