

**UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR**

THIRD YEAR SPECIAL/ SUPPLEMENTARY EXAMINATION

**FOR THE DEGREE OF
BACHELOR OF SCIENCE
IN
CIVIL ENGINEERING**

COURSE CODE: ECE 2313

COURSE TITLE: PUBLIC HEALTH ENGINEERING II

DATE:

TIME:

INSTRUCTIONS TO CANDIDATE

Answer ANY THREE QUESTIONS

Marks for each question are indicated in the parenthesis

1. (a) (i) Differentiate between Combined and Separated Sewers as encountered in sewerage systems **[2 marks]**
- (ii) Outline the advantages and disadvantages of the conventional gravity sewerage systems **[6 Marks]**
- (iii) List five rules for the location of a manhole in a sanitary sewer system **[5 Marks]**
- (iv) Under what Circumstances is the pumping of sewage necessary **[2 Marks]**
- (b) Distinguish among Primary, Secondary, and Tertiary treatments for municipal sewage. **[3 Marks]**
- (c) State TWO objectives and TWO limitations of the BOD test **[2 Marks]**
2. (a) Define the following terms as used in sanitary microbiology:
- (i) Autotrophes
- (ii) Synergistic reaction
- (iii) Coliform group of organisms **[3 Marks]**
- (b) What are the essential characteristics of a good indicator organism? Name four commonly used indicator organisms **[4 Marks]**
- (c) Determine the one (1) day BOD and the ultimate 1st stage BOD of a wastewater whose 5 day 20° C BOD is 200 mg/L. The reaction constant K (base e) = 0.23 **[5 Marks]**
- (d) Plot and illustrate the various distinct growth phases as a small culture of microorganisms are inoculated in a fixed volume of culture medium and the number of viable organisms recorded as a function of time **[8 Marks]**
3. (a) (i) Outline the significance of tests conducted on wastewater

for the determination of its chemical characteristics [2 marks]

(ii) Why do the COD and BOD analyses usually give different results for the same waste? [4 marks]

(ii) What could be inferred from the following analytical results concerning the relative ease of biodegradability of each waste?

Waste	5-day BOD (mg/L)	COD (mg/L)
A	240	300
B	100	500
C	120	240

[6 Marks]

(iii) Give four different applications for the COD analysis in environmental engineering practice [4 marks]

(b) List any of the **FOUR** compounds producing offensive odors in sewage and their respective odor quality [4 marks]

4. (a) Outline the importance of the following parameters in public health engineering

(i) Temperature

(ii) pH

(iii) Alkalinity

(iv) Dissolved Oxygen

[8 Marks]

(b) (i) Define the meaning of physical characteristic of wastewater [2 marks]

(ii) Show how solids as a physical characteristic are classified and explain how each category is tested in a sample of wastewater [10 marks]

5. (a) Describe the following major categories of wastewater [6 Marks]

(i) Sewage or black water

(ii) Sullage or grey water

(iii) Storm water or surface runoff

- (b) Define the following terms as encountered in sewerage systems **[3 Marks]**
- (a) Sewer
 - (b) Infiltration
 - (c) Inflow
- (c) The main goal of wastewater treatment processes is to produce clean effluents and protect public health. Describe the 'primary phase' of municipal wastewater treatment **[7 Marks]**
- (d) In Kenya, all treatment plant effluent is discharged into an inland stream or lake except for Mombasa where uncontrolled and untreated sewage is currently being discharged into the Indian Ocean. Outline the undesirable effects of marine sewage discharges. **[4 Marks]**