



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR OF
SCIENCE IN CIVIL ENGINEERING

ECV310: PUBLIC HEALTH ENGINEERING

DATE: 15/6/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

- *This paper comprises of five questions*
- *Question one is compulsory and carries 30 marks*
- *Answer any other two questions*
- *Reasonable assumptions should be made where necessary*

QUESTION ONE (COMPULSORY) (30 MARKS)

State and describe the sources of wastewater giving pertinent characteristics of each type of wastewater. Why is wastewater flow characterization important to the overall wastewater treatment scheme? (20 marks)

QUESTION TWO (20 MARKS)

- a) Discuss the importance of the following chemical pollutants found in wastewater
- Cyanide, CN
 - Chromium, Cr
 - Nitrate, NO
 - Phosphorous, P
 - Ammonia, NH_3 , NH_4^+
- b) Discuss the similarities and differences between Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) with reference to wastewater characterization. What is the relevance of the BOD: COD ratio when selecting treatment systems? (10 marks)

QUESTION THREE (20 MARKS)

- i. Distinguish between separate and combined sewers stating the advantages and disadvantages of each. List the materials that are often used for sewers. (10 marks)
- ii. Manholes are very important sewer appurtenances. What is their role and how are they located? (10 marks)

QUESTION FOUR (20 MARKS)

Design 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 2000 L/s. the choice of your design velocity should ensure that there is no deposition and sewer corrosion is minimal. Allow a 10% freeboard. Determine the required channel bottom slope for this sewer. (20 marks)

QUESTION FIVE (20 MARKS)

- i. Discuss the factors that necessitate the construction of household and small-scale wastewater treatment systems. Give five examples of these systems. (10 marks)
- ii. 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)