



MACHAKOS UNIVERSITY

University Examination 2018/2019

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: 24/5/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS: Attempt questions **ONE** and any other **TWO** questions.

- 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) List waterborne microbiological agents of greatest concern to the Public Health Engineer and discuss the infectious conditions associated with these agents (10 marks)
- b) Discuss the criteria used in selection of an on-site wastewater treatment system. (10 marks)
- c) Environmental pollutants can generally be categorized into physical, chemical and biological. Discuss the importance in relation to human and environmental health of the following chemical pollutants found in wastewater (10 marks)
 - i) Ammonia, NH_3 , NH_4^+
 - ii) Phosphorous, P
 - iii) Chromium, Cr
 - iv) Cyanide, CN
 - v) Nitrate, NO

QUESTION TWO (20 MARKS)

- a) There is often a distinction problem between cesspools and septic tanks as on-site treatment systems. Clearly distinguish the two and then discuss their advantages and disadvantages in a comparative manner. (10 marks)
- b) Estimate the size of a septic tank for a Machakos University hostel which hosts 500 residents on average daily. Assume that the anticipated flow is 100L/day per capita and HRT of 24hrs. Assuming an average depth of 1.8m and width:length ratio of 1:3 give the overall dimensions of the tank (10 marks)

QUESTION THREE (20 MARKS)

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

QUESTION FOUR (20 MARKS)

- a) Discuss the factors that necessitate the construction of household and small-scale wastewater treatment systems. Give five examples of these systems. (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 FIVE (20 MARKS)

A feasibility study has shown the suitability of a sanitary gravity sewer for a community. Design a sanitary gravity sewer of concrete ($n=0.013$), square in shape flowing half full and which 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. What will be the required channel bottom slope for this sewer?