MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIRST YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 303: PUBLIC HEALTH ENGINEERING I

DATE: **TIME:**

INSTRUCTIONS:

*Answer questions **ONE** and any other **TWO** questions.*

Reasonable assumptions should be made where necessary

QUESTION ONE (30 MARKS)

a) Water supply schemes can procure raw water from surface sources through river intakes and/or dam reservoir intakes and lake intakes. Discuss the necessary technical conditions for a successful dam construction project (10 marks)

b) By use of a flow chart briefly discuss the unit operations and processes that raw water goes through in a conventional water treatment process to produce drinking water. (10 marks)

c) Briefly describe the evolution of Public Health Engineering. Why is it being referred to as Environmental Engineering in the contemporary world? (10 marks)

QUESTION TWO (20 MARKS)

Settled water turbidity is generally in the range from 1 to 10 NTU with a typical value being 2 NTU. Because these levels of turbidity interfere with the subsequent disinfection processes, the turbidity must be reduced. With the aid of sketches, discuss, in sufficient detail, the process of filtration in a rapid sand filter. How does rapid sand filtration differ from slow sand filtration? (20 marks)

QUESTION THREE (20 MARKS)

a) The purpose of disinfection in water treatment is to reduce pathogens to an acceptable level and disinfection is not the same as sterilization. In view of this state the three categories of human enteric pathogens that are of concern in drinking water. List 5 common disinfecting agents used in the world (10 marks)

b) Explain what NOM is and why it may be one of the goals of coagulation/flocculation to remove it from drinking water. Hence or otherwise differentiate between the terms coagulation and flocculation. (10 marks)

QUESTION FOUR (20 MARKS)

Migingo Town has an existing horizontal –flow sedimentation tank with an overflow rate of $0.708 m^3/h.m^2$. What percentage removal should be expected for each of the following particle settling velocities in an ideal sedimentation tank: 0.01cm/s, 0.02cm/s and 0.1cm/s? (20 marks)

QUESTION FIVE (20 MARKS)

Show that when particles settle discretely in a sedimentation basin, the particle settling velocity can be obtained by the equation below, and the basin can be designed to remove a specific size particle. (20 marks)

$$v_s = \left[\frac{4g(\rho_s - \rho)d}{3\,C_D\rho}\right]^{1/2}$$

Where;

v_s= settling velocity

g= gravitational acceleration

ρ_s= density of particle

ρ=fluid density

C_D= drag coefficient

d=diameter of particle