



MACHAKOS UNIVERSITY

University Examination 2019/2020

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING
THIRD YEAR FIRST SEMESTER EXAMINATION FOR
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 303: PUBLIC HEALTH ENGINEERING I

DATE: 18/12/2019

TIME: 2.00-4.00 PM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

Reasonable assumptions should be made where necessary

QUESTION ONE (30 MARKS)

- a) Describe the possible four types of settling that can take place in a sedimentation tank. (10 marks)
- b) Calculate the diameter of a discrete particle in a sedimentation tank whose terminal settling velocity is 0.01044m/s . The particle density is 2.5g/cm^3 and the water temperature is 12°C . Assume Stoke's Law applies and that the density of water is 1000kg/m^3 . (10 marks)
- c) Define effective size and uniformity coefficient and explain their use in designing a rapid sand filter. (10 marks)

QUESTION TWO (20 MARKS)

- a) 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)
- b) 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)

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) Machakos Town has an existing horizontal –flow sedimentation tank with an overflow rate of $0.708\text{m}^3/\text{h.m}^2$. What percentage removal should be expected for each of the following particle settling velocities in an ideal sedimentation tank: 1mm/s, 2mm/s and 10mm/s. (10 marks)

QUESTION FOUR (20 MARKS)

- a) With the use of sketches describe any four (4) types of dams known to you. Your description should include materials used for construction, advantages and disadvantages of each, cost, and mode of operation. (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 FIVE (20 MARKS)

You have been tasked as a Consulting Engineer to design a water supply scheme for a high class housing suburb in Thika town and the design life of your system is to end in the year 2045. The demand for the suburb is described purely as residential. The population in this section of town has been obtained by census every 10 years by the Kenya National Bureau of Statistics as tabulated below. Calculate the initial, future and ultimate water demand using 2020 as the initial (base year). The design population in the town should be estimated using geometric growth projection.

Year	Population
1930	125000
1940	150000
1950	150000
1960	185000
1970	185000
1980	210000
1990	280000
2000	320000

<i>CONSUMER</i>	UNIT	<i>RURAL AREAS</i>			URBAN AREAS		
		High potential	Medium potential	Low potential	High Class Housing	Medium Class Housing	Low Class Housing
People with individual connections	1/head/ day	60	50	40	250	150	75
People without connections	1/head/ day	20	14	10	-	-	20
Livestock unit	1/head/ day	50			-		
Boarding schools	1/head/ day	50					
Day schools with WC without WC	1/head/ day	25 5					
Hospitals Regional District other	1/bed/ day	400) 200) 100)			+ 20 1 per outpatient and day (minimum 5000 1/day)		
Dispensary and Health Centre	1/day	5000					
Hotels High Class Medium Class Low Class	1/bed/ day	600 300 50					
Administrative offices	1/head/ day	25					
Bars	1/day	500					
Shops	1/da	100					
Unspecified industry	1/ha/day				20,000		
Coffee pulping factories	1/kg	25 (when recirculation of water is used).					