



UNIVERSITY OF EMBU

2016/2017 ACADEMIC YEAR

SECOND SEMESTER EXAMINATION

**FOURTH YEAR EXAMINATION FOR THE BACHELOR OF SCIENCE DEGREE IN
WATER RESOURCES MANAGEMENT AND BACHELOR OF SCIENCE IN
MANAGEMENT OF ENVIRONMENT AND AGROECOSYSTEMS**

AEM 402: SANITARY ENGINEERING

DATE: APRIL 13, 2017

TIME: 8:30-10:30AM

INSTRUCTIONS:

Answer Question ONE and ANY other TWO Questions

QUESTION ONE

- a) Differentiate between Groundwater infiltration and Storm water inflow in estimation of wastewater quantities (4 marks)
- b) Differentiate between a combined and separate sewer. (4 marks)
- c) Explain significance of “residual chlorine in water treatment” (4 marks)
- d) Describe four common methods that are used to treat ground water in an unconfined aquifer that is contaminated with volatile organic compounds. (4 marks)
- e) Highlight five different methods of Soil Vapor Extraction off-gas treatment. (5 marks)
- f) Differentiate between biopiles and soil composting methods as used in bioremediation (4 marks)
- g) Explain five factors which determine the rate of domestic water use, hence the rate of wastewater generation. (5 marks)

QUESTION TWO

- a) Explain six ways in which phytoremediation can be used as a site remediation strategy. (12 marks)

- b) Describe the steps that are used to determine whether Monitored Natural Attenuation (MNA) is a viable remediation strategy for a contaminated site. (8 marks)

QUESTION THREE

- a) A domestic water treatment plant is to be designed to supply a discharge of 35000 m³/day. Calculate the surface area (m²), volume (m³), and detention time (seconds) of a 3 m deep horizontal flow grit chamber which will remove grit with a specific gravity of >1.9 and a size >0.2 mm. The settling velocity as given by the Stokes law is:

$$V_s = \frac{g(\rho_p - \rho_w)d^2}{18\mu} \quad (12 \text{ marks})$$

- b) Explain four physical methods of domestic water treatment (8 marks)

QUESTION FOUR

- a) A certain city with a current population of 400,000 people and a waste production capacity of 350L/Capita/day intends to build a new sewerage plant. Assuming the design is supposed to cater for the projected population for the 25 years, calculate the following for the primary treatment:

- i) The projected population in 25 years, assuming annual population growth rate of 4% is:

(2 marks)

- ii) The design Average dry weather flow (ADWF)

(3 marks)

- iii) Peak average dry weather flow (PDWF)

(3 marks)

- iv) The head loss at the bar screen at peak velocity. Assume that the bar screen area is 1.5 m by 1.2 m.

(2 marks)

- v) Flow velocity at peak flow

(2 marks)

- b) With the help of schematic diagram, describe the working of a conventional activated sludge (8 marks)

QUESTION FIVE

- a) Explain six factors that must be considered in the design of landfills (12 marks)
- b) Describe four types of lining materials used in landfills (8 marks)

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