



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CIVIL AND WATER ENGINEERING

WASTEWATER ENGINEERING

TCW 3104

Supplementary Examination Paper

JULY 2016

This examination paper consists of 2 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: NONE

Examiner's Name: ENG. A CHINYAMA

INSTRUCTIONS

1. Answer ALL questions
2. Each question carries 25 marks
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
TOTAL	100

QUESTION 1

- a. With the aid of a neat sketch describe how an activated sludge process can be modified to enhance nutrient removal. (10 marks)
- b. Describe the similarities in the treatment processes in the septic tank and the ventilated improved pit latrine. What are the design considerations for a ventilated improved pit latrine? (15 marks)

QUESTION 2

- a. Determine the total sludge production from a treatment system consisting of primary clarification and a trickling filter plant treating $1000\text{m}^3/\text{day}$ with a BOD_5 of 210mg/l and Suspended solids of 260mg/l . Assume that primary clarification removes 30% BOD and 60% influent solids. (10 marks)
- b. With the aid of a neat sketch describe the processes which take place in a conventional wastewater treatment works. (15 marks)

QUESTION 3

- a. Describe the processes involved in surface water self-purification. (5 marks)
- b. Describe 'nutrients' in relation to water quality and pollution. How do they affect water bodies and what conditions increase these effects? (10 marks)
- c. Suggest measures that can be put in place to control the effects of nutrients in surface water bodies. (10 marks)

QUESTION 4

Design suitable dimensions of circular trickling filter units for treating 5 million litres of sewage per day. BOD of sewage is 150mg/l . Assume organic loading is $1500\text{kg/hectare/metre/day}$ and effective depth of filter as 2m . (25 marks)