ZIMBABWE

MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT

HIGHER EDUCATION EXAMINATIONS COUNCIL (HEXCO)

NATIONAL DIPLOMA

IN

CIVIL ENGINEERING

SUBJECT: Water and Sanitation Engineering **PAPER NO: 578/15/S07**
578/22/S05
578/23/M06

DURATION: 3 Hours

OCTOBER / NOVEMBER 2024 EXAMINATION

REQUIREMENTS

Calculator

INSTRUCTIONS TO CANDIDATE

1. Answer any five (5) questions.
2. Begin each question on a fresh page.

This paper consists of 3 printed pages.

PAPER NO: 578/15/S07
578/22/S05
578/23/M06 – WATER AND SANITATION ENGINEERING

QUESTION 1

a) What do you understand by:

i) Water hardness (2 marks)
ii) Turbidity (2 marks)
iii) Facultative bacteria (2 marks)
iv) Separate sewer system (2 marks)
v) Combined sewer system (2 marks)

b) State sources of ground water pollution and suggest possible solutions to prevent ground water pollution. (10 marks)

QUESTION 2

a) Differentiate permanent hardness from temporary hardness. (4 marks)

b) Explain in detail the following stages of water treatment:

i) Coagulation and flocculation (8 marks)
ii) Disinfection (8 marks)

QUESTION 3

a) State any five (5) methods that can be used to determine or measure amount of organic matter in waste water. (5 marks)

b) Explain the effects of high turbidity in a water body. (5 marks)

c) Explain in brief the biological characteristics of waste water. (10 marks)

QUESTION 4

a) Define flood routine. (2 marks)

b) Explain what you understand by the term "water balance equation". (5 marks)

c) Using the Kostiakov equation, calculate the infiltration rate of a soil over 3 holes with the following constants a = 40, b = 0,5 (5 marks)

d) State any eight (8) (onsite) sanitation technology systems. (8 marks)

QUESTION 5

a) What is incineration of waste? (2 marks)

b) How is sludge in waste water treated and disposed safely? (8 marks)

c) Explain what you understand by the term "water balance equation". (5 marks)

d) How are water borne diseases controlled? (5 marks)

QUESTION 6

a) Describe how the following methods are used in river discharge measurements.

i) Current meter (4 marks)
ii) Weirs and flumes (4 marks)

b) Describe the multiple tube fermentation technique and the membrane filter techniques on how they are used in determination of total coliform bacteria. (12 marks)

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