



ZIMBABWE

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

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

HIGHER NATIONAL DIPLOMA

IN

CIVIL ENGINEERING

SUBJECT: Water and Sanitation Engineering II PAPER NO: 778/17/S05

DURATION: 3 Hours

MARCH/APRIL 2024 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

Answer ANY FOUR (4) questions.

PAPER NO: 778/17/S05 – WATER AND SANITATION ENGINEERING II

QUESTION 1

- (a) Give three (3) main objectives of wastewater treatment in Zimbabwe. (3 marks)
- (b) What is B.O.D ? why is it used to assess the degree of contamination of water? (2 marks)
- (c) B.O.D and C.O.D are very important parameter in the design of waste water plants. Compare and contrast B.O.D and C.O.D as measures of pollution strength of sewage. (6 marks)
- (d) Draw a sketch of an inactivated sludge wastewater treatment plant including the sludge treatment units. (14 marks)

QUESTION 2

- (a) Define the following terms:
- (i) Sewer (2 marks)
 - (ii) Sewage (2 marks)
 - (iii) Sewerage (2 marks)
 - (iv) Effluent (2 marks)
- (b) Distinguish between a separate and combined sewer system and state areas where each is best suited. (6 marks)
- (c) Determine the size of a circular sewer for a discharge of 600l/s running half-full. Assume $i = 0.001$ and $\pi = 0.015$. (8 marks)
- (d) List any three characteristics of a good sewer design. (3 marks)

QUESTION 3

- (a) (i) Define the term intake as applied to water engineering. (2 marks)
- (ii) Identify any five (5) factors you would consider when selecting an intake site. (2 marks)
- (b) Mention any five (5) factors affecting the rate of water demand in a given community. (5 marks)
- (c) A 3m diameter propeller pump is installed to deliver a large quantity of water over a 2.6m elevation head. If the shaft power supplied to the pump is 1500kw and if the pump operates at 80% efficiency determine the discharge rate. ($K_{in} = 0,5$ and $K_{out} = 1,0$) (8 marks)
- (d) What are the five (5) causes of head loss in a water pipeline? (5 marks)

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QUESTION 4

- (a) Explain the differences between a dam and a reservoir. (2 marks)
- (b) Briefly explain what an Earthfill dam is and give types and examples. (7 marks)
- (c) How are dams classified under the Zimbabwe water Act 1998?(6 marks)
- (d) In Zimbabwe there are four (4) main types of dams in respect to the materials used to construct them. Can you list them. (4 marks)
- (e) List six site characteristics or factors which influence the selection of the type of dams listed in (d) above. (6 marks)

QUESTION 5

- (a) State any five (5) sanitary precautions that need to be taken to protect ground water sources. (5 marks)
- (b) Outline the construction and operation of a septic tank as an on site sanitation technique. (2 marks)

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