

UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Sciences

BSc Environmental Health

SUPPLEMENTARY EXAMINATION PAPER JULY 2014

TITLE OF PAPER : INDUSTRIAL WASTE MANAGEMENT I
COURSE CODE : EHS:553

DURATION : 2 HOURS

MARKS : 100

INSTRUCTIONS : THERE ARE FIVE QUESTIONS IN THIS EXAM
: ANSWER ANY 4 OF THE 5 QUESTIONS
: EACH QUESTION CARRIES 25 MARKS
: NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE
EXAMINATION ROOM

EHS 553
SUPPLEMENTARY
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QUESTION ONE (25 Marks)

An aerated grit chamber is to be designed for the treatment of industrial waste water. The average flow rate is $1.5 \text{ m}^3/\text{sec}$. Assume a daily peaking factor of 2.75. Because it is required to drain the chamber periodically for maintenance two chambers will be needed. The average detention time at peak flow is to be taken as 4 minutes. The width to depth ratio is to be 1.5:1 and assume the depth is 3 meters. The air supply rate is $0.3 \text{ m}^3/\text{min.m}$. The rate of grit generated is $0.05 \text{ m}^3/1000 \text{ m}^3$ at peak flow.

- A. Determine the volume of each grit chamber.....[5 marks]
- B. Determine the dimension of each grit chamber.....[5 marks]
- C. Determine the detention time in each grit chamber at peak flow.....[5 marks]
- D. Determine the air supply requirement.....[5 marks]
- E. Estimate the quantity of grit at peak flow.....[5 marks]

QUESTION TWO (25 Marks)

- A. Suggest five methods for the neutralization of acidic or alkaline industrial waste waters.
.....[5 Marks]
- B. Write down the reaction that occurs when soda ash is added for the neutralization of carbonic acid wastes.
.....[5 Marks]
- C. Write down the reaction that occurs when caustic soda is added for the neutralization of sulfuric acid wastes.
.....[5 Marks]
- D. Discuss the parameters that must be considered in the design of pH control system.
.....[10 Marks]

QUESTION THREE (25 Marks)

- A. It is desired to determine the number of samples necessary to carry out a given heavy metal analysis from an industrial waste water sample to a satisfactory level. The expected standard deviation for the heavy metal is $5\mu\text{g/L}$. It is desired that the experimentally determined value of the heavy metal must not vary from the true value by more than one standard deviation. Assuming a 95% confidence level with $Z=2$, determine the number of samples required.....[12 Marks]
- B. A regular monitoring test of a given heavy metal on an industrial waste water effluent gave a value of $22\mu\text{g/L}$. The number of repetition measurements was 6. The standard deviation has been established as $1\mu\text{g/L}$. If the maximum effluent limit for the heavy metal was $20\mu\text{g/L}$, determine whether there is significant difference between the measured concentration and the effluent limit. The critical t value at 95% confidence level for 6 repetitions is given as 2.776.....[13 Marks]

QUESTION FOUR (25 Marks)

Discuss the impact of industrial waste water pollution with respect to the quality parameters given below:

- A. Colour, taste and odour.....[5 Marks]
- B. Temperature.....[5 Marks]
- C. Hardness.....[5 Marks]
- D. Heavy metals.....[5 Marks]
- E. Organic chemicals and nutrients.....[5 Marks]

QUESTION FIVE (25 Marks)

State in each of the following cases whether grab sampling or composite sampling is appropriate. Give reasons for your choice. (Each question carries 5 marks).

- A. It is desired to study the variation of the waste water characteristics over time.
- B. Sampling is required for the determination of dissolved oxygen, temperature and pH
- C. Sampling is required for the design of waste water treatment units after an equalization basin.
- D. Sampling is required for the determination of nitrogen and phosphorous as parameters affecting microbial growth in biological waste water treatment units.
- E. Sampling is to be taken from the effluent of a waste stabilization pond.