NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOLOGY
FACULTY OF APPLIED SCIENCES

DEPARTMENT OF ENVIRONMENTAL SCIENCE AND HEALTH

FINAL EXAMINATIONS

SANITATION AND WASTEWATER TREATMENT: ESH 4118

January 2013 Time Allowed: 3 Hours Total Marks 100

INSTRUCTIONS TO CANDIDATES:

Answer any FOUR questions. Each question carries 25 marks.

Question 1

Explain the interactions between the natural and human generated water cycles.

Question 2

a) Analyse the conventional wastewater treatment process and why it can be viewed as a thickening process. **(15 marks)**

b) Discuss the characteristics of industrial wastewater that render it difficult to treat by biological processes. **(10 marks)**

Question 3

a) Give a detailed explanation why wastewater has to be treated before disposal in relation to the oxygen sag curve. **(8 marks)**

b) Laboratory analysis tests commonly run to measure gross amounts of organic matter including BOD and COD. Outline the advantages and disadvantages of the two tests.

(7 marks)

c)Elaborate on the statement , "BOD is not a single point measure but time dependent".

(10 marks)

Question 4

a) Analyse the treatment mechanism in biological filters. **(18 marks)**

b) Given that the BOD in a primary effluent applied to a filter bed is 250mg/l, the volume of the filter media is $100m^3$ and the surface area of the filter is $5m^2$. The bio filtration plant serves a residential and industrial area which release 9 $000m^3$/day with a recirculation ratio of 20%.

Calculate:

i) BOD loading **(3 marks)**

ii)Hydraulic loading **(4 marks)**

Question 5

a) Differentiate activated sludge systems from waste stabilization ponds. **(16 marks)**

b) An activated sludge treatment plant has an average flow of 12 $000m^3$/day. The primary clarifier at the plant has a total surface area of $30m^2$ and a weir with a length of 20m.

Calculate:

i) Overflow rate **(3 marks)**

ii) Detention time **(3 marks)**

iii) Effluent weir loading rate **(3 marks)**

Question 6

6) Give a detailed analysis of the causes and effects of poor sanitation and hygiene practices in peri urban and rural areas in Zimbabwe.

End of question paper

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SUPPLEMENTARY EXAMINATIONS

SANITATION AND WASTEWATER TREATMENT: ESH 4118

Year 2013 Time Allowed: 3 Hours Total Marks 100

INSTRUCTIONS TO CANDIDATES:

Answer any FOUR questions. Each question carries 25 marks.

Question 1

Explain the hydrological cycle and how its natural purification processes are used in wastewater treatment.

Question 2

Discuss the different types of solids found in wastewater, methods used for their determination and their role in determining water quality.

Question 3

a)Describe the biological processes in the filter bed of a trickling filter plant. **(12 marks)**

b) A trickling filter plant has the following units: A primary clarifier with an 18m diameter, 2.3 side depth and a single peripheral weir; a 28m diameter trickling filter with a 2.3m stone-filled bed; and a final clarifier with a 15m diameter; 2.3 m water depth and single peripheral weir. The normal operating recirculation ratio is 30% with return from the final clarifier. The daily wastewater flow is 6 000m^3/day with an average BOD of 200mg/l.

i) Calculate the loadings on all the units **(9 marks)**

ii) What is he anticipated BOD at 20^0C? (Assume primary settlement removal efficiency of 35% and filter efficiency of 78% at 20^0C) (**4 marks)**

Question 4

a) Explain nitrification and denitrification in Biological Nutrient Removal systems **(20 marks)**

b) From a resource point of view explain why nitrification is considered a waste of resources. **(5 marks)**

Question 5

Analyse ecological sanitation as a viable option for sanitation for low income earning groups.

Question 6

Discuss the suspended growth treatment mechanisms used in Zimbabwe.

End of Question paper