# UNIVERSITY OF SWAZILAND
# Faculty of Health Sciences

## DEGREE IN ENVIRONMENTAL HEALTH

## FINAL EXAMINATION PAPER 2008

| | | |
|---|---|---|
| **TITLE OF PAPER** | : | **INDUSTRIAL WASTE MANAGEMENT I** |
| **COURSE CODE** | : | **EHS 553** |
| **DURATION** | : | **2 HOURS** |
| **MARKS** | : | **100** |
| **INSTRUCTIONS** | : | **READ THE QUESTIONS & INSTRUCTIONS CAREFULLY** |
| | : | **ANSWER ONLY FOUR QUESTIONS** |
| | : | **QUESTION ONE AND TWO ARE COMPULSORY** |
| | : | **EACH QUESTION CARRIES 25 MARKS** |
| | : | **WRITE NEATLY & CLEARLY** |
| | : | **NO PAPER SHOULD BE BROUGHT INTO NOR OUT OF THE EXAMINATION ROOM** |
| | : | **BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER** |

**DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.**

**EHS 553 Final Examination 2008**
**Industrial waste management**

---

**Question one**

a) What do you understand by biochemical oxygen demand for wastewater and of what relevancy to wastewater treatment? (explain five points) (10 Marks)

b) Fully describe the BOD test procedures (10 Marks)

c) Waste water was found to be oxidized as if it where a mixture of components of 40% was oxidized at rate of 0.8/d, 40% at oxidized at rate 0.08/d and 20% at 0.008/d. How much BOD remaining in a day and in 5 days. (5 Marks)

**Question two**

a) What is the purpose of a grit chamber at the wastewater treatment plant? (4 marks)

b) Mention three requirements for the grit chamber to achieve desired results. (6 Marks)

c) Describe three ways by which grit can be removed from wastewater. (10 Marks)

d) How will you design a horizontal grit chamber to try and keep the surface loading rate and the horizontal flow velocity within certain ranges, while coping with the fluctuating hydraulic flow rate over a day? (5 Marks)

**Question three**

a) Explain the reason behind the two limits of the flow velocity in the approach channel of screens in the wastewater treatment plant and explain why this velocity needs to be controlled. (3 Marks)

b) Mention the limits of the flow velocity between the bars of the screens for wastewater treatment and say why this velocity needs to be controlled. (2 Marks)

c) What do you understand by sedimentation in wastewater treatment? (3 Marks)

d) A screen was designed with the following parameters:

1. Flow rate 2.0 $m^3/s$
2. Design horizontal flow velocity ($v_h$) = 0.08 m/s in the approach channel.
3. Depth of the channel 1.0 m
4. Bar thickness = 10mm
5. Assume Fc = 0 Fa = 0.5 sin = $30^o$

---

What is the:

i. Cross sectional area of the channel (4 marks)

ii. Width of the channel? (3 marks)

iii. Number of bars of the screen (4 marks)

**Question four**

Given that the hydraulic retention time for a sedimentation tank designed for industrial wastewater treatment is 2hrs.

a. What is the volume of the tank when the inflow is 50 litres per second (50L/s)? (5 marks)

b. Given that the tank above (a) is to be used to treat the inflow how many tanks do we need? (Assume the depth). (10 marks)

a) A company produces wastewater with pollution levels exceeding limits for municipal sewer line discharge; describe how you will persuade it to install an onsite pre treatment before discharging into a municipal sewerage system. (10 marks).