National Examination, December 2011

04-Env-B5 Industrial & Hazardous Waste Management

3 hours duration

NOTES:

1. The total possible examination mark is **100**.
2. This examination is an **OPEN BOOK EXAM.**
3. A Casio or Sharp approved calculator is permitted.
4. ***If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.***
5. All **16** questions constitute a complete paper.

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5 marks **1.** Name 5 strategies you could use to reduce industrial waste strength.

6 marks **2.** For an industrial wastewater process stream, what strategies would you consider for the removal of:

1. inorganic dissolved solids
2. the removal of organic dissolved solids

20 marks **3.** You have determined that, after compiling the data below and data obtained from laboratory studies, that the wastewater is biologically treatable. You wish to explore:

3.1 the size of Aeration Basin required, (m^3)
3.2 the Oxygen requirement (if using surface aeration), kg O_2/kWh
3.3 and the amount of Sludge produced, kg/d

PARAMETER	UNITS	EXCEEDANCE VALUE	
EFFLUENT CRITERIA		50%	90%
BOD_5	mg/L	*30*	*50*
SS	mg/L	*20*	-
RAW WASTEWATER CRITERIA			
Q	m^3/d	4000	5000
BOD_5	mg/L	650	850
SS	mg/L	30	50
oils	mg/L	5	10
OH- alkalinity (as $CaCO_3$)	mg/L	800	-
phenols	mg/L	10	12
TKN (as N)	mg/L	82	95
TP (as P)	mg/L	3	5

Reaction Rate Coefficient, **k = 0.0133/d** *from lab data*
Maintain MLSS concentration of **3500 mg/L** (assume 85% MLVSS)
Need **F/M < 0.3** at minimum organic loading condition *from lab data*
alpha = **0.70** *from lab data;* beta = **0.90**
T_{summer} = **24 °C**; C_s @ T_{summer} = **8.33** mg/L
T_{winter} = **12 °C**; C_s @ T_{winter} = **10.75** mg/ L
No = 1.76 kgO_2/kWh (from equipment manufacturer)
State clearly any assumptions made.

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20 marks **4.** A large industry wishes to locate in your community. A process wastewater will be produced from their widget manufacturing process. You have been engaged by this industry to come up with a cost-effective wastewater management strategy.

4.1 Outline the steps you would take for your assignment.

4.2 Write an index to your report that you will prepare for your client.

4.3. Once you have an index, write one brief sentence giving information about the content of what you will present under that report heading.

3 marks **5.** How do you define a hazardous waste?

4 marks **6.** What are 4 properties of a hazardous waste?

5 marks **7.** Name 5 typical hazardous wastes found in residential sources.

5 marks **8.** Name 5 typical hazardous wastes from commercial sources.

3 marks **9.** What is one of the critical issues in the long term management of hazardous compounds?

8 marks **10.** Determine the time required for the concentration of tuloene and Dieldrin spilled in a shallow leachate treatment pond to be reduced to one half their initial values. Assume the first order removal constants for toluene and Dieldrin are 0.0665/hr and 2.665×10^{-5} /hr, respectively.

5 marks **11.** What are the principal physical transformations that alter the form of the hazardous constituents found in municipal solid waste (MSW)?

2 marks **12.** What is the most effective way to eliminate the small quantities of hazardous wastes now found in municipal solid waste?

2 marks **13.** What is considered to be the key to the elimination of all discharges of hazardous wastes from commercial activities?

3 marks **14.** Name 3 common strategies to minimize the improper disposal of household hazardous waste.

4 marks **15.** Name 4 critical components of a hazardous waste plan.

5 marks **16.** What is the biggest challenge in the management of biomedical waste?

100 marks total