National Examination, December 2015

04-Env-B5 Industrial & Hazardous Waste Management

3 hours duration

NOTES:

1. The total possible examination mark is 100.

2. This is a CLOSED BOOK EXAM. An 8 ½” x 11” aid sheet (both sides) and any non-communicating calculator are permitted.

3. 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.

4. All 18 questions constitute a complete paper.

5. Clarity and organization of the answers are important.
1. Name 5 strategies you could use to reduce liquid industrial waste strength.

2. How would you handle (remove) emulsified oils from an industrial wastewater?

3. a) Name 5 industries and the hazardous material(s) in their production process residuals.
   b) What hazard reduction strategies would you consider for each of these industries?

4. In point form outline the steps you would take to conduct an Industrial Waste Survey.

5. Name 5 methods of disposing (removing/managing) hazardous waste.

6. Given the following data, calculate the gas production rate from a chicken farm:
   - chickens = 200,000
   - each chicken produces an average of 0.00019 m³/d of manure
   - COD, \( C_i \) = 150,000 g/m³
   - HRT of anaerobic reactor = 12 days
   - Growth rate, \( r_g \) = 600 g/m³·d
   - fraction of COD removed = 0.79
   - \( CH_4 \) produced/kg COD destroyed = 0.37 m³

7. What is one of the critical issues in the long term management of hazardous compounds?

8. A pharmaceutical product production company has asked you to advise on a management strategy for their waste pharmaceutical products. In point form, list the steps you would take. Are there any treatment options? If so, identify them in point form.


10. How do you define a hazardous waste?

11. What are 4 properties of a hazardous waste?
15. 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.
   12.1 Outline the steps you would take for your assignment.
   12.2 Write an index to your report that you will prepare for your client.
   12.3 Once you have an index, write one brief sentence giving information about the content of what you will present under that report heading.

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

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

6. 15. A particular industrial waste contains a bio-inhibitory compound. You have determined that biological treatment would be the best process option if this bio-inhibitory compound were not present. Identify, and discuss briefly how you would handle this challenge.

10. 16. Identify in tabular form the important process design variables for:
   16.1 an incinerator
   16.2 a membrane separator
   16.3 a conventional activated sludge process
   16.4 an anaerobic digester
   16.5 an aerobic digester
   State why each parameter is important.

4. 17. Name 4 critical components of a hazardous waste plan.

2. 18. What is the biggest challenge in the management of bio-medical waste?