National Examination May 2015

04-Env-A6-Solid Waste Engineering and Management

3 hours duration

NOTES:

1. There are a total TWELVE (12) examination questions on 2 pages.

2. Each question is of the value indicated. There are *100 possible* marks for the examination.

3. This is a **CLOSED BOOK EXAM.**

4. Candidates are permitted **ONE** (1) letter sized aid sheet (8.5 "x 11") both sides.

5. One of two calculators is permitted any Casio or Sharp approved models.

6. **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 for the solution of the examination questions.**

7. Clarity and organization of the answers are important.

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5   **1. Define:**
        1.1   Darcy's Law
        1.2   Pyrolysis
        1.3   Vadose zone
        1.4   Landfill mining
        1.5   Vector control

20   **2. Name and briefly discuss:**
        2.1 - 3 important criteria in the design of a composting operation.
        2.2 - 4 basic considerations in designing a landfill.
        2.3 - 3 factors to consider in leachate control from a landfill.
        2.4 - 3 different leachate treatment processes.
        2.5 - 3 variables that govern landfill gas production.
        2.6 – 4 problems associated with landfilling of municipal waste.

8   **3.** In your first position as Junior City Engineer you are assigned by your supervisor to report on the generation rates and composition of solid wastes for various sources of your community.
        3.1   How would you go about it?
        3.2   If these data were needed in 30 days, and thus you had no time to assess seasonal effects, how would you estimate this factor?

5   **4.** Why is compacted density an important consideration?
        4.1   How would you calculate it?

6   **5.** Determine the thickness of a clay layer necessary to limit seepage of leachate to about 0.2 liters/day/unit area. Assume that the water table is located at the bottom of the landfill and that the leachate level in the landfill above the clay layer is to be maintained at 1 m by pumping. The K value for the clay material to be used is 0.0008 m^3/m^2.d. $Q = -KA dh/dL$

10   **6.** Name the important design considerations (criteria) for aerobic composting and state why they are important.

8   **7.** As consulting engineer, you have been commissioned by council to devise a strategy for extending the life of the community landfill. Outline what you would propose.

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5   8. Explain briefly the role of particle size in a composting process?

10   9. Identify and briefly outline the factors you would use in a life cycle analysis of a proposed composting operation.

8   10. What factors must you consider in the selection of a site for a landfill?

10   11. Sketch and identify all components of a typical landfill cross-section.

5   12. Briefly describe what the three T's in incineration are and their importance.

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