

NATIONAL EXAMINATION, MAY 2019

18-Env-A6-Solid Waste Engineering and Management

3 hours duration

Notes:

1. Question 1 is compulsory, attempt any three questions from the remaining four questions.
2. If doubts exist as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
3. This is a closed book exam. However, one aid sheet is allowed written on both sides.
4. An approved Casio or Sharp calculator is permitted.
5. Marks of all questions are indicated at the end of each question.
6. Clarity and organization of answers are important.

Q1 (25 marks)

Give a brief description of the following in municipal solid waste management.

- i. Key concerns with a landfill **(5 marks)**
- ii. Waste transformation via composting **(5 marks)**
- iii. Landfill Liners **(5 marks)**
- iv. Principal landfill gas constituents **(5 marks)**
- v. landfill closure and post closure care **(5 marks)**

Q2 (25 marks)

- a. List and briefly describe the steps involved in composting **(9 marks)**
- b. Describe the key causes of odour in a composting facility **(9 marks)**
- a. Name the key parameters that define the quality of the final compost product **(7 marks)**

Q3 (25 marks)

- a. Describe the key features of biological activity and leachate composition of Phase 3 (acid phase) of a landfill **(12 marks)**
- b. Briefly describe and differentiate between Trench Method and Area Method of landfill design **(13 marks)**

Q4 (25 marks)

- a. What do you understand by passive control of landfill gases? Briefly describe the operation of Perimeter Interceptor Trenches and Slurry Walls as passive control measures for landfill gases. **(10 marks)**
- b. You completed an analysis of a municipal solid waste and summarized its' composition in the following Table. Using these data, estimate the percent moisture and dry solids contents, and bulk density of this municipal solid waste. **(15 marks)**

Component	Mass per 100 kg (kg/100 kg-solid waste)	Moisture %	Density kg/m ³
Paper	45	7	100
Organics	35	70	300
Metal (Fe)	7	3	480
Glass	10	2	160
Ash	3	8	480

Q5 (25 marks)

- a. Sketch a cross section through a sanitary landfill and name all associated components. **(15 marks)**
- b. Describe briefly the importance and usage of cover material in a landfill. **(10 marks)**