

This question paper contains 3 printed pages.

3169

Your Roll No.

MEC

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Paper – CE.668

SOLID WASTE MANAGEMENT

Time : 3 hours

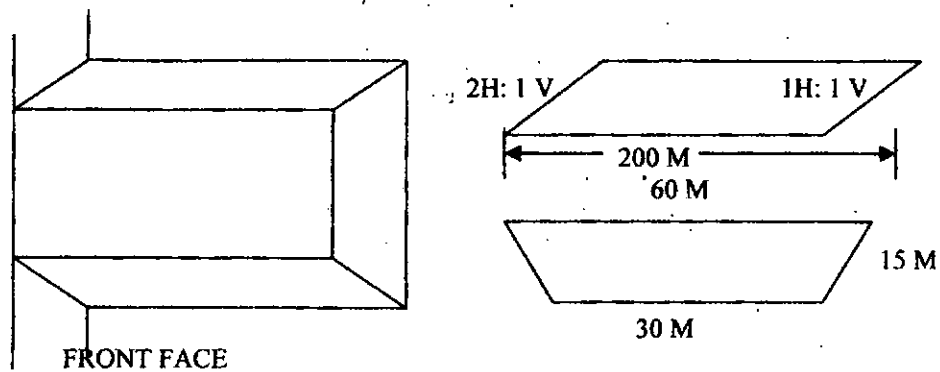
Maximum Marks : 100

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any five questions. Assume suitable missing data wherever needed. Draw neat labelled diagrams wherever needed.

- Q. 1(a)** Explain, How solid wastes are classified? Discuss the factors affecting solid wastes generation? [10]
- Q 1(b)** Draw a neat labeled diagram of a modern sanitary landfill indicating various components of it. [10]
- Q 2(a)** Solid wastes from a commercial area are to be collected using a stationary container collection system having 4 m³ containers. Determine the appropriate truck capacity for the following conditions. Container size = 4 m³, container utilization factor = 0.75, average number of containers at each location = 2, collection vehicle compaction ratio = 2.5, container unloading time = 0.1 hr/container, average drive time between container locations = 0.1 Hr, one way haul distance = 30 km, speed limit = 88 km/hr, time from garage to first container location = 0.33 hr, time from last container location to garage = 0.25 hr, number of trips to disposal site per day = 2, length of workday = 8 hr, a = 0.016, b = 0.011. [10]
- Q 2(b)** What is Pyrolysis? Discuss the chemistry of pyrolysis process. Make a comment on status of pyrolysis process as solid waste disposal option. [10]
- Q 3(a)** What are the objectives of screening in solid waste processing? Discuss using illustrations, various types of screens used for solid waste processing. [10]
- Q 3(b)** Determine the capacity of solid waste disposal site as shown in accompanying figure. The total height of each lift is 3m. Ratio of solid waste to cover material is 5:1. [10]

Turn over



Q 4(a) Describe the process of aerobic Composting and its benefits. Discuss the various design considerations of aerobic composting process? [10]

Q 4(b) Determine the amount of oxygen required to oxidize 1000 Kg of an organic solid waste aerobically. Assume that the initial composition of the organic material to be decomposed is given by $[C_6H_7O_2(OH)_3]_5$, that the final composition of the residual organic matter is estimated to be $[C_6H_7O_2(OH)_3]_2$, and that the 400 Kg of the material remains after the oxidation process.. [10]

Q 5(a) Discuss using illustrations, the variation in the generation of different constituents of landfill gas (LFG). Write typical composition of landfill gas. [10]

Q 5(b) Discuss various active measures which may be adopted for the control of gases in a landfill. [10]

Q 6(a) What is a Leachate? What are the processes contributing towards Leachate? Discuss the factors affecting quantity and quality of leachate [10]

Q 6(b) Make a comparison of Geosynthetic Clay Liner (GCL) and Compacted Clay Liner (CCL). [10]

Q 7(a) What is a landfill cover. Describe using illustrations, the various layers of landfill final cover system and their function. [10]

Q 7(b) Determine the breakeven time for stationary container system and a separate transfer and transport system for transporting wastes collected from a metropolitan area to a landfill disposal site. Assume the following cost

Transportation costs

- (i) Stationary container system using 18 m³ compactor = Rs. 200 per hour
- (ii) Tractor trailer transport unit with a capacity of 120 m³ = Rs. 250 per hour

Other costs

- (i) Transfer station operating cost = Rs. 4 per m³
- (ii) Extra cost for unloading facilities for tractor trailer transport unit = Rs. 0.5 per m³

Other data

- (i) Density of wastes in a compactor = 325 kg/ m³
- (ii) Density of waste in transport unit = 150 kg/m³

[10]

Q 8(a) Discuss the process of Gasification and the chemical reactions involved in it. Describe briefly a gasifier system most commonly used.

[10]

Q 8(b) Discuss various types of devices used for size reduction of solid wastes.

[10]