

M.E.C.E. 1st YEAR EXAMINATION, 2025
(1st Semester)
SUBJECT: Solid and Gaseous Waste Management

Full Marks 100

Time: Three hours

Use a separate Answer-Script for each part

No. of Questions	Part I (40 Marks for This Part)	Marks
	Answer Question 1 (compulsory) and any two from the rest. Assume any data if not provided. All the drawings should be in pencil.	
Q1. (A)	Write the importance of following characteristics in association with solid waste management. i. Field capacity ii. Fusing point of ash iii. Permeability iv. Biodegradable fraction	2×4
(B)	Write in brief the significances of the following factors in association with the solid waste generation: i. Existing rules and regulations ii. Season and geographic area	1×2
Q2. (A)	Discuss the factors that you have to consider to design an on-site storage facility for high rise buildings. Write the advantages and disadvantages of community bin collection system collection considering public and municipal workers points of view.	3+4
(B)	Determine the number of samples to be collected for plastics in India having ranges between 2.5-6.5% having average percentages 4 and standard deviation 0.07 for confidence level 95%.	5
(C)	Determine the high calorific value for the solid waste using modified Dulong's formula for the solid waste having chemical formula: C ₆₅₅ H ₁₇₂₁ O ₇₅₄ N ₁₁₅ S	3
3. (A)	With derivation proof break-even time analysis does not depend on the distance between collection points to transfer station but on transfer station to facility site.	5
(B)	The solid waste generated per week in a residential complex is 700 kg. There are two containers each with a capacity of 5 kg at the rear of each house. The solid wastes are collected by a two-person crew using a 35 kg manually loaded compactor vehicle once a week. The disposal site is located 15 km away from the collection points, haul constants a and b are 0.022h/trip and 0.025h/km respectively, the container utilization factor is 0.7 and the compaction ratio is 2. Assume the collection is based on 8-h day. The average pick up time per container is 3 min, the average drive time between the containers are 6 min, the average time to empty the truck at the disposal site is 15 minutes time from garage to first container is 20 minutes and disposal site to garage is 15 minutes. Drawing the neat labeled schematic picture of the collection system described determine the number of collection vehicle required for the area.	8+2
4. (A)	What is the top most option of hierarchy of integrated solid waste management system specified in Solid waste management rule, 2016.	1
(B)	Differentiate between: i. Material balance analysis and weight volume analysis ii. Proximate characteristics and ultimate characteristics iii. At site time and haul time	2×3

[Turn over

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Q4. (C)	<p>After plotting the weekly solid waste production for a half calendar of operation for a residential area in a probability paper it was obtained that the plotting position of 30, 35, 40, 45 and 50 m³/week waste generations are 30%, 65%, 90%, 98.4% and 99.9% respectively. Using these waste generation data, determine the most cost-effective container size to make extra pickup trips, on call, instead of using a larger sized container. Consider the following data given below: Cost per trip = Rs 500/trip; Useful life of container = 10 years; Discount rate =12%</p>	8																								
<table border="1"> <thead> <tr> <th>Container Vol (m³)</th> <th>Capital cost (Rs)</th> <th>Annual O & M cost (Rs/yr)</th> <th>Plotting Position</th> </tr> </thead> <tbody> <tr> <td>30</td> <td>3000</td> <td>150</td> <td>30 %</td> </tr> <tr> <td>35</td> <td>3500</td> <td>175</td> <td>65 %</td> </tr> <tr> <td>40</td> <td>4000</td> <td>225</td> <td>90 %</td> </tr> <tr> <td>45</td> <td>5000</td> <td>300</td> <td>98.4%</td> </tr> <tr> <td>50</td> <td>6500</td> <td>400</td> <td>99.9 %</td> </tr> </tbody> </table>			Container Vol (m ³)	Capital cost (Rs)	Annual O & M cost (Rs/yr)	Plotting Position	30	3000	150	30 %	35	3500	175	65 %	40	4000	225	90 %	45	5000	300	98.4%	50	6500	400	99.9 %
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