KUMARAGURU college of technology
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Register Number:……..…

M.E DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

First Semester.

ENVIRONMENTAL ENGINEERING

P18EET1004**:** Solid and Hazardous Waste Management

COURSE OUTCOMES

CO1: Manage solid and hazardous waste constituents based on Indian legislation.

CO2: Analyse and characterize the solid waste for source reduction.

CO3: Optimize the solid waste collection and transport systems.

CO4: Apply various steps involved in the Solid waste treatment and disposal techniques.

CO5: Economically implement the onsite vs. offsite waste management options.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The size of waste components can be determined using which of the following equations: CO1 [K_1]

   a) Sc = L

   b) Sc = (L+w)/2

   c) Sc = (L+w+h)/3

   a) Both a and b
   b) a, b and c
   c) only b
   d) only c

2. The average composition of MSW is CO1 [K_1]

   a) 41% organic, 40% inert & 19% recyclable
   b) 19% organic, 41% inert & 40% recyclable
   c) 30% organic, 20% inert & 50% recyclable
   d) 20% organic, 60% inert & 20% recyclable

3. A residential area consisting of 1400 houses has an average of 3 residents per house. For estimating the quantity of solid wastes generated, the following observations were made at disposal site for a period of one week. The total quantity of wastes generated was 48650 kg/ week. Determine the unit rate of solid wastes generation CO2 [K_3]

a) 1.90 kg/capita/day
b) 1.15 kg/capita/day
c) 1.45 kg/capita/day
d) 1.65 kg/capita/day

4. Matching type I item (biomedical waste) with Type II (colour code used for segregation). CO3 [K_2]

List I (Biomedical Waste)	List II (Colour Code)
A. Soiled Waste	i. Yellow
B. Anatomical waste	ii. Blue
C. Infected Plastic	iii. Red
D. Drug and chemical waste	iv. Black

a) A-iii, B-i, C-ii, D-iv
b) A-ii, B-iv, C-i, D-iii
c) A-ii, B-iii, C-iv, D-i
d) A-iv, B-ii, C-iii, D-i

5. Determine the value of Bilo-degradable fraction of the food wastes that has the lignin content of 0.4 % CO2 [K_2]

a) 0.912
b) 0.762
c) 0.818
d) 0.111

6. For a selected hazardous landfill site, if the water table is within 2,0m to 6.0m, which of the following liner is adopted? CO3 [K_2]

a) Single
b) Double
c) Triple
d) Multi-Liner

7. Assertion (A): Recycled paper is banned for use in food containers. CO4 [K_2]
Reason (R): The paper is very thick and can't cover the food containers.

a) Both A and R are true but R is the correct explanation for A
b) A is true but R is not the correct explanation for A
c) A is false but R is true
d) Both A and R are false

8. WHO classified the biomedical waste into _____ categories. CO4 [K_2]

a) 5
b) 4
c) 3
d) 2

9. Sequence the stages of waste decomposition. CO5 [K_2]

1. Anaerobic Decomposition
2. Aerobic Decomposition
3. Non methanogenic decomposition

a) 1-3-2 b) 1-2-3

c) 2-3-1 d) 2-1-3

10. Considering a case where surfactant is added by injecting in the groundwater, but not pumped out of the site/system. The total mass of the contaminant in such a case, compared to the case when no surfactant is injected: CO5 [K_3]

a) Decreases b) Entirely degrades

c) Remains the same d) Increases

PART B (10 x 2 = 20 Marks)

11. State the key role of public in solid waste management. CO1 [K_2]
12. What are the harmful effects that occur due to improper handling of solid waste? CO1 [K_2]
13. Summarize the advantages and limitations of waste exchange. CO2 [K_2]
14. Illustrate the factors affecting the generation rates of solid waste. CO2 [K_2]
15. List the different types of collection services employed in solid waste management system. CO3 [K_1]
16. Specify the role of transfer station in municipal solid waste management. CO3 [K_2]
17. Summarize the objectives of waste processing. CO4 [K_2]
18. What is meant by solidification and stabilization of hazardous waste. CO4 [K_2]
19. Sketch the layout of a landfill site and mention the elements of a landfill. CO5 [K_2]
20. Compare an open dump and an engineered Landfill. CO5 [K_2]

PART C (6 x 5 = 30 Marks)

21. MSW is generated within the community from several sources, not just the household. Classify the solid waste based on sources and types. CO1 [K_2]

22. Discuss the method of determination of toxicity characteristics in solid waste. CO2 [K_2]

23. Compare and contrast in detail about the Stationary and hauled container system. CO3 [K_2]

24. Explain the processing techniques: 1) Magnetic separation and ii) Air Separation. CO4 [K_2]

25. Asses the key characteristics of an engineered sanitary landfill that distinguishes it from an open dump. CO5 [K_3]

26. Explain the stages involved in waste decomposition CO4 [K_2]

Answer any FOUR Questions
PART D (4 x 10 = 40 Marks)

27. Derive an approximate molecular formula for the organic portion of a solid waste sample with the following table. Using the chemical composition obtained, determine the energy content of this sample. CO1 [K_3]

Component	Moist mass (kg)	% of Chemical component present in the sample					
		C	H	O	N	S	Ash
Food wastes	15	0.48	0.64	0.38	0.03	0.004	0.05
Paper	45	0.43	0.06	0.44	0.003	0.002	0.06
Cardboard	10	0.23	0.03	0.24	0.002	0.001	0.026
Wood	20	0.11	0.013	0.09	0.0004	0.0002	0.003

28. Explain the properties and characteristics of Municipal Solid waste. CO2 [K_2]

29. Explain in detail the different types of collection systems based on the mode of operation CO3 [K_2]

30. Compare the various thermal processes and bring out your opinion about the best thermal process that can be adopted in solid waste treatment. CO4 [K_2]

31. Discuss the criteria considered for site selection in landfill development, considering environmental, social, and economic factors. CO5 [K_2]

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