

06CE6144

EXAM SLOT:D

Reg. No _____

Name _____

A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY

**M.TECH DEGREE EXAMINATION, MAY 2016
SECOND SEMESTER**

Branch: Civil Engineering

Specialization: Environmental Engineering

Solid & Hazardous Waste Management

Time: 3 Hours

Max. Marks: 60

PART A

Answer all questions

- I. 1. Describe how sampling of solid waste is carried out. (5 Marks)
2. A landfill area of 200m x 150m is available for handling 25 years municipal solid waste for a town of 750000 people. Out of the total landfill area only 75% is actually available for landfill and other is used for auxiliary services. Assuming that average per capita MSW discard per year in town is 0.06 tonne, landfill density is 500 kg/m³, and that the 20% of the actual landfill cell volume is used for soil cover, estimate
- The landfill lift in one year
 - Number of years for which the landfill can be used if the landfill can't be increased beyond 25m. (5 Marks)
3. Explain the different sources of hazardous waste (5 marks)
4. Explain cell floatation treatment of hazardous waste (5 marks)
- II. 5. Explain the different types of collection systems (10 Marks)

Or

6. Because of a difference of opinion among the city staff members, you have been retained as an outside consultant to evaluate the collection operation of a city. The basic question centers around the amount of time spent on off route activities by the collectors. The collectors say that they spend less than 15% of each 8-h workday on off route activities; management claims that the amount of time spent is more than 15%. You are given the following information that has been verified by both the collectors and management.

- a) A hauled container system, without container exchange is used
- b) The average time spent driving from yard to the first container is 20 min and no off route factor activities occur.
- c) The average pickup time per container is 6 min.
- d) The average time to drive between containers is 6 min.
- e) The average time required to empty the container at the disposal site is 6 min
- f) The average round trip distance to the disposal site is 10 mi/trip and the haul constants are $a = 0.004$ h/trip and $b = 0.02$ h/mi.
- g) The time required to redeposit a container after it has been emptied is 6 min
- h) The average time spent driving from the last container to the corporation yard is 15 min and no off route activities occur
- i) The number if containers emptied per day is 10.

From this data, determine whether the truth is on the side of the collectors or the management. Assume missing data (if any) suitably. (10 Marks)

7. (a) Draw the flow diagram of anaerobic digestion process. (5Marks)
- (b) Explain the factors affecting anaerobic digestion (5 Marks)

Or

8. (a) Explain different types of landfilling methods. Draw suitable diagrams. (5 Marks)
- (b) Explain the control of landfill gas movement by recovery. (5 Marks)

- 9.(a) Explain the identification of hazardous waste using its characteristics. (5 Marks)

(b) Explain the identification of hazardous waste using lists provided by Government agencies. (5 marks)

Or

10. (a) Explain about the on-site storage of hazardous waste. (5 Marks)

(b) What are the requirements for transportation of hazardous waste? (5Marks)

11.(a) Explain air stripping treatment of hazardous waste. (5 Marks)

(b) Explain soil vapour extraction treatment of hazardous waste (5 Marks)

Or

12. (a) Explain the different categories of bio-medical waste and the respective treatments given. (10 Marks)

D

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A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY

M.TECH DEGREE EXAMINATION, APRIL/MAY 2017

SECOND SEMESTER

Branch: Civil - Environmental Engineering

Solid and Hazardous Waste Management (Elective II)

Time: 3 Hours

Max. Marks: 60

PART A

Answer ALL questions

1. Briefly explain various solid waste collection services.
2. What are the factors affecting anaerobic composting.
3. How we can identify hazardous waste?
4. What are the advantages of segregation of biomedical waste.

(4 x 5 marks =20 marks)

PART B

5. a) Write about solid waste generation and methods of estimation. (4 marks)
b) Write down the various factors affecting generation rate of solid waste. (6 marks)

OR

6. Explain the characterisation of solid waste. (10 marks)
7. a) Write about different types of incinerators. (6 marks)
b) Explain the recycling process of metal & plastic. (4 marks)

OR

8. Explain the design & operation of landfills. (10 marks)

9. a) Write about transfer and transport of hazardous waste. (4 marks)
b) Explain disposal methods for hazardous waste. (6 marks)

OR

10. Which are the factors contribute to waste minimization and pollution prevention of hazardous waste? (10 marks)

11. a) What are the factors involved in operation of land treatment. (6 marks)
b) Explain thermal treatment of hazardous waste. (4 marks)

OR

12. Explain various stages of biomedical waste management. (10 marks)

(4 x 10 marks =40 marks)

Exam Slot: D

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A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY
M.TECH DEGREE EXAMINATION, APRIL/MAY 2018
SECOND SEMESTER
Environmental Engineering
Solid and Hazardous Waste Management (Elective 2)

Time: 3 Hrs

Maximum Marks:60

PART A

Answer ALL Questions

1. What are the functional elements of solid waste management system?
2. Write short note on:
 - (a) Mass Burning System (2.5 Marks)
 - (b) Refused Derived Fuel. (2.5 Marks)
3. Define hazardous waste. How do you distinguish a hazardous waste from municipal waste?
4. Explain the thermal treatment techniques for hazardous waste management.

4 x 5 marks = 20 marks

PART B

5. Estimate the (i) Moisture Content, (ii) Density, (iii) Energy Content on Dry Basis, and (iv) Energy Content on Ash Free basis for a municipal solid waste sample with the following compositions (Table 1).

Table 1. Typical composition of solid waste sample generated from house hold practices.

Sl. No	Component	Percentage by mass	Moisture Content (%)	Density (Kg/m^3)	Energy as discarded basis (kJ/kg)
1	Food Waste	15	70	290	4650
2	Paper	45	6	85	16,750
3	Cardboard	10	5	50	16,300
4	Plastic	10	2	65	32,600
5	Garden Trim-mings	10	60	105	65,000
6	Wood	5	20	240	93,000
7	Tin Cans	5	3	90	3,500

OR

6. Explain in detail the household solid waste collection, transportation, and disposal methods practiced in India.
7. An ultimate analysis was performed for a solid waste sample of 1 tonne and derived a chemical formula of $C_{50}H_{100}O_{40}N$. The solid waste was decided to treat either by aerobic composting or anaerobic digestion.
- (a) Determine the air required to oxidize the waste completely by aerobic compost. (4 Marks)
- (b) Estimate the theoretical volume of methane gas expected from the anaerobic digestion. (4 Marks)
- (c) On the basis of the above information, which method do you suggest, and why? (2 Marks)

OR

8. (a) How do you quantify the leachate produced from a land fill site? (5 Marks)
- (b) Estimate the percolation of water through a land fill of 10 m deep with 1 m cover of sandy soil. The precipitation rate is 1025 mm/year, run off coefficient is 0.15, evaporation rate is 660 mm/year. Assume the soil at field capacity of 150 mm/m. (5 Marks)
9. Explain the various categories of hazardous waste based on their origin.

OR

10. (a) Explain in detail the concept of pollution prevention and waste minimization. (4 Marks)
- (b) What are the strategies adopted for pollution prevention and waste minimization for managing hazardous waste. (6 Marks)
11. A ground water supply has been contaminated with ethyl benzene. The maximum level of ethyl benzene in the ground water is 3mg/L and this must be reduced to $20\ \mu\text{g/L}$ by an air stripping column. The following data are provided.
- Liquid loading rate = $1360\ \text{mole/s/m}^2$.
- Liquid phase mass transfer rate (K_{La}) = $0.016/\text{s}$

Air to water ratio = 20

Henry's dimensionless constant = 0.27

Determine stripping factor (R), Height of Transfer Unit (HTU), Number of transfer unit (NTU), and height of packing column.

OR

12. An industrial plant generates a process wastewater stream that has an average flow of $440 \text{ m}^3/\text{minute}$ and 4800 mg/L of COD over the past 3 years. A regulatory agency has stated that the organic chemical constituents are hazardous and must be reduced to 50 mg/L measured as COD. The storm water runoff from the site also contributes the organic chemical of concern, and all runoff from an annual average rainfall of 60 cm must also be treated. The runoff measurements over 3 months reported a total of 12 cm of rainfall over that period which yielded $3 \times 10^6 \text{ m}^3$ of runoff containing 300 mg/L of COD. The treatability test of the process wastewater reported the following data:

$$\text{BOD} = 0.5 \times \text{COD}$$

$$\text{Biomass production rate} = 0.7 \text{ mg/mg BOD}$$

$$\text{Endogenous decay rate} = 0.05/\text{day}$$

$$\text{Sludge age} = 50 \text{ days}$$

$$\text{Hydraulic retention time} = 7 \text{ days}$$

The plant is evaluating the feasibility of treating the wastewater and runoff in a full scale completely mixed suspended growth system with solid recycle. On the basis of the above information, could a sufficient biomass concentration be maintained to prevent settling problems in a conventional system?

4 x 10 marks = 40 marks

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A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY
M.TECH DEGREE EXAMINATION, MAY/JUNE 2019
SECOND SEMESTER

ENVIRONMENTAL ENGINEERING

Solid and Hazardous Waste Management

Time: 3 Hrs

Maximum Marks: 60

PART A

Answer ALL Questions

1. Compose the chemical properties of solid waste.
2. Estimate the theoretical volume of methane gas expected from the anaerobic digestion of five tonne of waste having the chemical composition $C_{45}H_3O_{35}N_4$.
3. If the concentration of a contaminant in drinking water is 0.04mg/L, and the potency factor for the contaminant is 0.02 (mg/kg-day)⁻¹, then estimate the chronic daily intake and cancer risk if a 70- kg person drank 2 L of this water per day for 10 years during his 70 years life time.
4. Which are the low heat systems used in biomedical waste treatment? What are the guidelines for using each system?

4 x 5 marks = 20 marks

PART B

5. An argument aroused between the collectors and management of a solid waste collection centre in city. The collectors say that they spend less than 15% of each 8-hour workday on off-route activities; where management claims that the amount of time spent is more than 15%. You are given the following information that has been verified by both the collectors and management. Check whose argument is right? A hauled container system, without container exchange is used. The average time spent driving from garage to the first container = 20 min. Time required for each (pick up loaded container, unload empty container and drive between container locations) = 6 min/trip. Round-trip haul distance to

disposal site = 10 km/trip. Haul constants is 0.004 h/trip and 0.02 h/km. At-site time per trip is 6 min. The average time spent driving from last container to garage is 15 min. Number of trips per day is 10.

OR

6. Discuss the classification of solid waste based on sources and types.
7. Compare various separation techniques in solid waste management.

OR

8. How large transfer stations are designed?
9. Briefly explain the steps in hazardous waste management.

OR

10. Discuss about how a hazardous waste can be identified.
11. Differentiate between incineration and pyrolysis methods for hazardous waste treatment.

OR

12. Explain the different stages in bio medical waste management.

4 x 10 marks = 40 marks