(Time: 3Hours) **Max Marks: 80**

N.B. 1. Question No.1 is compulsory

2. Attempt any **three** questions from remaining **five** questions.

3. Assume any suitable data where ever required.

4. Figures to the right indicate full marks.

Q.1 Attempt any **four**

a. What is optimization of routes? **05**

b. Determine the number of $7.5m^3$ containers required per week for waste collection after compaction, for a colony with 200 houses, 3 people per house. The generation rate is 0.6kg/person/day. The compacted specific weight is $250kg/m^3$. **05**

c. Explain sampling of solid waste. **05**

d. Draw neat sketch of 'Conventional mode of Hauled Container System' **05**

e. What is toxicity testing? How is it carried out for hazardous waste? **05**

Q.2 a. Explain Hospital solid waste with **10**

1) Categories of waste

2) Quantities and composition

3) Storage

4) Transportation

5) Treatment and Disposal

b. Estimate the energy value of typical residential Municipal Solid waste with the average composition $C_{760}H_{1980}O_{875}N_{13}S_1$. **10**

Q.3 a What is Sanitary landfilling? Explain the recovery of gas from sanitary landfill. **10**

b. Define composting. What are the various considerations to achieve composting efficiency maximum. **10**

Q.4 a. Explain physical, Chemical and Biological transformation in solid waste management .Also write down the importance of waste transformation. **10**

b. Determine the amount of air required to oxidize one tonne of waste with the chemical composition $C_{60}H_{90}O_{30}N_1$. **10**

$$C_aH_bO_cN_d + \left(\frac{4a+b-2c-3d}{4}\right)O_2 \rightarrow aCO_2 + \frac{b-3d}{2}H_2O + dNH_3$$

Q.5 a. Explain with diagram working of Municipal Incinerator. Also explain air pollution control measures adopted in Incinerators. **10**

b. Estimate the theoretical volume of methane gas that could be expected from anaerobic digestion of one tonne of waste having the composition of $C_{45}H_{90}O_{35}N_1$. **10**

$$C_aH_bO_cN_d + \left(\frac{4a-b-2c-3d}{4}\right)H_2O \rightarrow \left(\frac{4a-b-2c-3d}{8}\right)CH_4 + \left(\frac{4a-b+2c+3d}{8}\right)CO_2 + dNH_3$$

Q.6 Write short note on **any four** **20**

a. E-waste management

b. Plastic waste management

c. Pyrolysis

d. Legal aspect of solid waste Disposal

e. Significance of chemical properties of solid waste

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