(3Hours) Max Marks=80

Note 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. Explain the term 'colour coding' as is used in relation to the biomedical wastes, and how does it help on safe disposal of bio-medical wastes? 05

b. Estimate density of solid waste sample from the given data. 05

Components	% by weight	Typical density(kg/m3)
Food waste	35	290
Glass	5	195
plastic	15	65
Paper	13	85
Wood	25	240
Ferrous Metal	2	320
Miscellaneous	5	240

c. Discuss what is being done in developing nations to encourage the reuse of materials. 05

d. Explain in short solid waste management in fruit processing Industries. 05

e. What is called as optimization of collection route? 05

Q.2 a. Estimate the theoretical volume of methane gas that could be expected from anaerobic digestion of one tonne of waste having the composition of $C_{55}H_{110}O_{35}N_2$. 10

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

b. Explain physical, chemical and Biological transformation of solid waste. 10

Q.3 a. Determine the amount of air required to oxidize one tonne of waste with the chemical composition $C_{50}H_{100}O_{40}N_1$. 10

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

b. What is Leachate? How it is formed? How its movement is controlled? 10

Q.4 a. What are the different characteristics of hazardous waste? How such a waste stored, transported and disposed. 10

b. Explain the working of municipal incinerator with neat sketch. Explain the air pollution control measures adopted in conjunction with incinerator. 10

Q.5 a. Estimate the energy content of solid waste (on dry basis and ash free dry basis) with the following composition is given in a table below. 10

Components	% by Mass	Energy KJ/Kg
Food wastes	35	4650
Paper	20	16750
Cardboard	15	16300
Plastics	10	32600
Garden Trimmings	5	6500
Wood	12	18600
Tin Cans	3	700

b. Explain with neat sketch of 'Hauled Container System' and 'Stationary Container System' 10

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

a. Storage load Transfer station
b. Indore method of composting
c. E-waste management
d. Trench method of land filling
e. Material recovery Facility

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