Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (ENVIRONMENTAL ENGINEERING)

END SEMESTER EXAMINATIONS, MARCH-2021

SOLID AND HAZARDOUS WASTE MANAGEMENT

[CIE 5184]

Date of Exam: 01-03-2021 **Time of Exam:** 2pm to 5pm **Max. Marks: 50**

Instructions to Candidates:

- Answer ALL the questions
- Missing data may be suitably assumed

1A	Draw materials flow and generation diagram of solid wastes in a technological society	**02**	**CO1**
1B	Describe the following factors affecting the generation rates of Municipal solid wastes? a) Geographic location b) Collection frequency c) Use of kitchen grinders d) Legislation	**04**	**CO1**
1C	Describe *any one* landmark episodes that propelled proactive approach towards dealing with Hazardous waste.	**02**	**CO1**
1D	List 2 examples each in organic and hazardous waste components in typical MSW	**02**	**CO1**
2A	The solid waste from a city comprises of following components as given in the below table. If the moisture content is 21% and ash content is 6%, Estimate: (i) As discarded energy content (ii) Energy content on dry basis.	**04**	**CO1**

Component	Wet Mass (kg)	Typical "As Discarded" Energy Content (MJ/kg)
Food Waste	20	4.65
Paper	50	16.75
Cardboard	8	16.3
Plastics	6	32.6
Garden Trimmings	6	6.5
Wood	5	18.6
Tin Cans	5	0.7

2B	Differentiate between direct discharge and storage transfer stations and explain about sanitary requirements of transfer station	**04**	**CO2**
2C	Draw a neat labeled diagram of shredder and magnet system of waste processing	**02**	**CO2**
3A	Differentiate between Positive and Negative approaches used in waste sorting	**02**	**CO2**
3B	Differentiate between Windrow composting system and in vessel composting system	**02**	**CO3**
3C	If the aerobic stabilization of municipal solid waste occurs as per the following equation: $C_aH_bO_cN_d + \frac{4a+b-2c-3d}{4} O_2 \longrightarrow aCO_2 + \frac{b-3d}{2} H_2O + dNH_3$ Assuming the air contains 20% oxygen by weight and density of air is 1.2 kg/m^3, then determine the mass and volume of air required to completely oxidize 1 ton of waste having the chemical equation C_{60} H_{120} O_{30} N_3. Neglect oxygen required for stabilization of ammonia.	**04**	**CO3**
3D	Define the term "Storage" with reference to hazardous waste management and mention the maximum period of storage for the collected hazardous waste	**02**	**CO3**
4A	List and explain the methods of estimating the gas production potential of existing landfill.	**06**	**CO4**
4B	Write the objectives of the Environmental monitoring system of a landfill and name the zones in which environmental monitoring is carried out	**04**	**CO4**
5A	What is leachate and explain its formation process	**04**	**CO4**
5B	In absence of readily available data, how would you estimate the waste quantity in a landfill?	**02**	**CO5**
5C	Briefly explain decontamination step in the case of radioactive waste management and name few typical decontaminants used	**04**	**CO5**