Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY



## II SEMESTER M.TECH. (INDUSTRIAL BIOTECHNOLOGY)

## END SEMESTER EXAMINATIONS, APR/MAY 2017

SUBJECT: Elective III SOLID WASTE MANAGEMENT [BIO 5252]

**REVISED CREDIT SYSTEM** 

Time: 3 Hours

MAX. MARKS: 50

## Instructions to Candidates:

✤ Answer ALL the questions.

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✤ Missing data may be suitable assumed.

1 <b>A</b> .	Explain the functional elements of SWM and Illustrate the interrelationships of each										5
	elements.										5
1B.	What are the important characteristics of SWM?										
1C.	Explain the legal aspects of solid waste management system.										
2A.	Derive an approximate formula for the organic portion of a solid waste ample with the										
	composition given below										
	Component	Wet	Moisture	Energy	Chemical Composition, Kg						
		mass,	Content	(KJ/Kg)	С	Н	0	Ν	S	Ash	
		Kg	(% by								
			wet								
			weight)								
	Food Wastes	15	70	4650	48	6.4	37.6	2.6	0.4	5	7
	Paper	45	6	16750	43.5	6	44	0.3	0.2	6	
	Cardboard	10	5	16300	44	5.9	44.6	0.3	0.2	6	
	Plastics	10	2	32600	60	7.2	22.8	0	0	10	
	Garden		60	6500	47.8	6	38	3.4	0.3	4.5	
	trimmings	10									
	Wood	5	20	18600	49.5	6	42.7	0.2	0.1	1.5	
	Tin cans	5	3	700	55	6.6	31.2	4.6	0.15	2.5	
2B	Estimate the energy content of a solid waste sample with the following composition. What										
	is the content or	n a dry ba	asis and on a	an ash-free	dry basi	is? Ass	ume the	e moist	ure con	itent	3
	of the sample is 21 % and ash content is 5%. (Use the above Table in Q2A)										
3A.	The solid waste treatment site collects 14 tons of raw produce (on a given day), 5 tons of										8
	cans, 0.5 tons of cartons, and 0.3 tons of miscellaneous materials. Of the 14 tons of raw										

	produce, 12 tons become processed product, 1.2 tons end up as produce waste, which is							
	fed to cattle, and the remainder is discharged with the wastewater from the plant. Four tons							
	of the cans are stored internally for future use, and the remainder is used to package the							
	product. About 3 % of the cans used are damaged. Stored separately, the damaged cans							
	are recycled. The cartons are used for packaging the caned product, except for 3 % that							
	are damaged and subsequently separated for recycling. Of the miscellaneous materials,							
	25 % is stored internally for future use; 50 % becomes waste paper, of which 35 % is							
	separated for recycling with the remainder being discharged as mixed waste. Assume the							
	materials separated for recycling and disposals are collected daily. Prepare a materials							
	balance for the cannery on this day and a materials flow diagram accounting for all of the							
	materials. Also determine the amount of waste per ton of product.							
3B.	Draw a neat sketch of hauled and stationary container system.	2						
4A.	A person weighing 65 Kg consumes an average of 50g of fish every week. The fish has							
	been caught from a pond with a concentration of DDT equal to 1.0 ppb. The	4						
	bioaccumulation factor for DDT is 54000 and the potency factor is 0.34(mg/kg/day) <sup>-1</sup> .							
	Estimate the maximum lifetime risk of cancer due to this exposure.							
4B.	Explain the CPCB criteria for selection of site for hazardous waste landfills.	3						
4C.	Explain the thermal transformation process used for hazardous waste	3						
5A.	A landfill area of (150 m x 100 m) is available for handling 25 years' municipal solid waste							
	(MSW) for a town of 5,00,000 people. Out of the total landfill area only 80% is actually							
	available for land fill and other is used for auxiliary services. Assuming that average pe							
	capita MSW discard per year in town is 0.05 tonne, landfill density is 500 kg/m <sup>3</sup> , and that							
	the 15 percent of the actual landfill cell volume is used for soil cover, estimate (a) the							
	landfill lift in one year. (b) number of years for which the land fill can be used if the landfill							
	can't be increased beyond 25 m.							
5B.	Draw a cross-section of landfill site and list the various elements of landfill site	4						
5C.	List the important types of final cover used in landfill site with neat sketch.	3						