# GURU NANAK INSTITUTE OF TECHNOLOGY
## An Autonomous Institute under MAKAUT
## 2022
## WASTE MANAGEMENT OF FOOD INDUSTRIES
## FT701

**TIME ALLOTTED: 3HR** **FULL MARKS:70**

***The figures in the margin indicate full marks.***
***Candidates are required to give their answers in their own words as far as practicable***

### GROUP – A
### (Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

| | | Marks | CO No |
|---|---|---|---|
| 1. i) | The BOD of a liquid waste can be characterized by<br>(a) MLVSS<br>(b) TSS<br>(c) MLSS<br>(d) Both (b) & (c) | 1 | CO1 |
| ii) | A Trickling Filter media should have<br>(a) High surface area to volume ratio<br>(b) High strength and reliability<br>(c) All of these<br>(d) None of These | 1 | CO4 |
| iii) | UASB is commonly known as<br>(a) Underflow anaerobic Sludge Bioreactor<br>(b) Upflow Activated Sludge Bioreactor<br>(c) Upflow Anaerobic Sludge Blanket<br>(d) Underflow Anaerobic Sludge Blanket . | 1 | CO2 |
| iv) | Functional elements of MSW management programme will be<br>(a) Waste generation and handling<br>(b) Waste separation and collection<br>(c) Waste processing and disposal<br>(d) All of these | 1 | CO1 |
| v) | Activated sludge process does not require<br>(a) Temperature control<br>(b) Aeration<br>(c) Recycling of biomass<br>(d) Pressure control | 1 | CO2 |
| vi) | Degree of decomposition of solid waste can be measured by<br>(a) Final drop in temperature<br>(b) Oxygen uptake rate<br>(c) Starch iodine taste<br>(d) All of these | 1 | CO4 |

| | | | |
|---|---|---|---|
| vii) | For the composting of any organic material C/N ratio should be around<br>(a) 20-25<br>(b) 25-30<br>(c) 30-35<br>(d) 35-40 | 1 | CO1 |
| viii) | Fermentation of waste materials through anaerobic route produces<br>(a) Gases of bad odors<br>(b) Gases of bad odor and vitamins<br>(c) Gases of bad odors and minerals<br>(d) None of these. | 1 | CO4 |
| ix) | The methane and carbon dioxide bears the ratio in biofuel as<br>(a) 4:1<br>(b) 2:3<br>(c) 3:2<br>(d) none of these. | 1 | CO4 |
| x) | Example of industrial waste<br>(a) oil cake<br>(b) Rotten grain<br>(c) twigs<br>(d) stubble | 1 | CO1 |
| xi) | For a waste water sample which of the following relations holds good?<br>(a) BOD>COD<br>(b) BOD=COD<br>(c) BOD<COD<br>(d) BOD≥COD | 1 | CO1 |
| xii) | Air supply available is less than that required for complete combustion in case of:<br>(a) Pyrolysis<br>(b) Incineration<br>(c) Gasification<br>(d) Sand Bed Drying | 1 | CO4 |

## GROUP – B
## (Short Answer Type Questions)

(Answer any *three* of the following) **3 x 5 = 15**

| | | Marks | CO No |
|---|---|---|---|
| 2. | Describe the mechanism of biogas generation through anaerobic route in an ideal biogas plant | 5 | CO2 |
| 3. | Describe pyrolysis with diagram | 5 | CO4 |
| 4. a. | What are the major sources of Dairy waste? | 1 | CO1 |
| b. | What are the important characteristics of dairy waste? | 2 | CO1 |
| c. | Give the layout of dairy waste treatment strategy. | 2 | CO1 |

| | | Marks | CO No |
|---|---|---|---|
| 5. | If $BOD_5$ of a sample measured at 20°C is 250 mg/L. Determine 3- day BOD at 27°C. Assume $K_{20oC}$ is 0.23 $d^{-1}$ and coefficient of temperature activity is 1.06 | 5 | CO3 |
| 6 a. | What is flocculation and sanitization? | 2 | CO3 |
| b. | What is the major step of liquid wastewater treatment? | 3 | CO3 |

## GROUP – C
## (Long Answer Type Questions)

(Answer any *three* of the following) **3 x 15 = 45**

| | | Marks | CO No |
|---|---|---|---|
| 7. a. | Describe the different aspects of aerobic composting. | 7 | CO4 |
| b. | Explain activated sludge process with diagram. | 8 | CO4 |
| 8. | 0.6 t of solid waste from the market place is treated to produce compost in an in-vessel composting system. If forced aeration is provided, determine the quantity of air required actually and capacity of the blower in $m^3$/minute based on maximum consumption of oxygen in a day using the following data: composition of solid waste : $C_{60}H_{95}O_{40}N$; Moisture content of solid waste: 30% (wb); Volatile Solids(VS) : 0.9 x TS; Biodegradable volatile solid (BVS): 0.6 x VS; Expected conversion efficiency of BVS = 90%; Composting period = 5 days; Maximum oxygen demand is 30% during successive five days of composting. Ammonia produced is released into atmosphere. Air contains 23% $O_2$ by mass and its density is 1.2 kg/m3. A factor of 1.8 times the quantity of theoretical air required to get actual supply of air. | 15 | CO3 |
| 9. a. | A fruit and vegetable processing unit generates 1 ton of solid waste that needs to be stabilized aerobically. Estimate the amount of oxygen required to oxidize the waste. It may be assumed that the initial composition of the biodegradable organic material to be decomposed is $[C_6H_7O_2(OH)_3]_5$ and the final composition of the residual organic matter is $[(C_6H_7)_2(OH)_3]_2$. After the oxidation process, 40% of the material is available as compost. Determine the amount of compost. | 8 | CO3 |
| b. | With a neat diagram, explain the operation of horizontal fixed bed gasifier. | 7 | CO3 |
| 10. | Short note: | | |
| a. | UASB Technology | 5 | CO2 |
| b. | Rotating biological contactor | 5 | CO2 |
| c. | Ion exchange method | 5 | CO2 |
| 11. a. | With a schematic diagram, describe the rotating biological contractor system. | 10 | CO2 |
| b. | Mention the advantages of this system. | 5 | CO2 |