

Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH/FT(O)/SEM-5/FT-504/2012-13

2012

WASTE MANAGEMENT OF FOOD INDUSTRIES

Time Allotted : 3 Hours

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)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$
 - i) If BOD value of influent waste water is high, one should select for its treatment,
 - a) Trickling filter
 - b) RBC
 - c) UASB
 - d) any one of these.
 - ii) Activated sludge process does not require
 - a) Recycling of biomass
 - b) Aeration
 - c) Temperature control
 - d) Pressure control.

5461(O)

[Turn over



- iii) Under anaerobic condition fluidization condition can be achieved by
- a) Aeration
 - b) Agitation
 - c) Spurning of waste water
 - d) none of these.
- iv) Thermal treatment process of solid waste under anaerobic condition
- a) does not exist
 - b) is possible, if partly aerobic and partly anaerobic
 - c) is possible by pyrolysis
 - d) is done at 55°C.
- v) Calorific value of landfill gas can be increased by
- a) absorbing oxygen from the gas
 - b) removing nitrogen from the gas
 - c) absorption of carbon dioxide
 - d) absorption of ammonia.
- vi) All of the following except are variations of activated sludge treatment.
- a) Modified aeration
 - b) Tapered aeration
 - c) Dispersed growth aeration
 - d) Step aeration.



- vii) Inorganic ions in waste water do not cause which of the following ?
- a) Deposition of scales on distribution pipes
 - b) Induce growth of some micro-organisms
 - c) Cause visible sludge which creates unsightly conditions of water body for recreational use
 - d) Interfere with brewing in beverage industry and affect the quality of the end product.
- viii) The efficiency of sedimentation tank for removal of suspended solids does not depend on which of the following factors ?
- a) Sludge removal
 - b) Temperature
 - c) BOD
 - d) Particle size.
- ix) Physical treatment methods used extensively in the process industries to recover various products from dilute solutions include
- I. Evaporation
 - II. Distillation
 - III. RO
 - IV. Carbon adsorption.
- Of these :
- a) only (I)
 - b) only (II)
 - c) (I), (II) (III)
 - d) all of these.

CS/B.TECH/FT(O)/SEM-5/FT-504/2012-13



- x) The type of biological waste treatment selected for food industry waste depends mainly on
- degree of treatment required
 - volume of waste
 - concentration of organic matter
 - capital and operating costs.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

- Before composting aerobically, the empirical formula for a particular solid waste was determined as $(C_6H_{10}O_5)_7$. If 60% of this solid waste is decomposed, calculate the weight of air (oxygen = 21 mole %) that would be required per tonne of solid waste.
- Describe the vermicomposting method for biological treatment of solid waste and mention its advantages.
- From the kinetic data given below, calculate the minimum cell retention time and the minimum substrate concentration as mg BOD_L/L in the outgoing effluent of a biological treatment plant.
 - Maximum rate of substrate consumption per unit mass of micro-organism $(k) = 10 d^{-1}$
 - Yield coefficient $(Y) = 8 \text{ mg } BOD_L/L$



iii) Half-velocity constant (K_s) = 8 mg BOD_L/L

iv) Decay rate of organisms (b) = 0.2 d⁻¹.

5. Write short notes on the following :

- i) Major waste Water Quality Parameters which influence the design and operation of a treatment system.
- ii) Ion Exchange treatment of waste water.

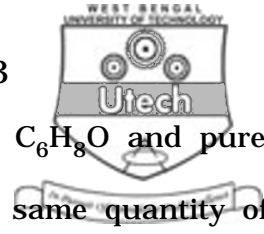
GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

6. With neat sketch briefly discuss how the following anaerobic treatment plants function :
- a) Anaerobic filter
 - b) UASB
 - c) Anaerobic RBC.
7. a) Determine the volume of gaseous fuels at NTP that can be produced by pyrolysis of 1.0 tonne of solid wastes. The relevant data are given below :
- i) Solid waste contains 30% moisture
 - ii) The chemical formula of solid waste on dry weight basis is C₆H₁₀O₈.
 - iii) 3 moles of dry solid waste give 8 moles of H₂ O, 2 moles of CO, 2 moles of CO₂, 1 mole of CH₂ and 1 mole of H₂.

CS/B.TECH/FT(O)/SEM-5/FT-504/2012-13



- b) How many kilograms of liquid fuel C_6H_8O and pure carbon C will be obtained from the same quantity of solid waste, if 1 mole of liquid fuel and 7 atoms of C are produced from 3 moles of solid waste ?
8. 1000 m^3 per day of waste water is released from a phenol manufacturing unit. Your responsibility is to design on activated sludge plant to reduce the phenol content of waste water from 150 mg/ml to 0.05 mg/ml or less, which is the requirement of the Pollution Control Board. For design purposes, following biological coefficients are applicable :
- i) $X_o = 0$
 - ii) $Y = 0.65\text{ g (VSS) }_a/\text{g phenol}$
 - iii) $k = 8\text{ g phenol/g (VSS) }_a (d)$
 - iv) $b = 0.1/d$
 - v) $K_s = 1\text{ mg phenol/L.}$
- a) Determine the cell retention time θ_c for the design of this plant and also justify any assumptions made.
 - b) Determine the reactor volume using the calculated θ_c . Justify assumptions made.



9. The waste characterization study was done for the effluents from different food processing industries like Dairy, Cannery and Meat Packing, Rendering and Poultry Plant wastes.
- i) Mention the significant characteristics of waste obtained from each industry.
 - ii) Give a detailed outline of the waste treatment strategies employed in each of the industries.
10. a) Discuss the significance of Biofilters in waste water treatment.
- b) Cite suitable examples and explain the different methods employed to recover useful materials from effluents of food industries.

