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 × 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.

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 pyrolis

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.

x) The type of biological waste treatment selected for food industry waste depends mainly on

a) degree of treatment required

b) volume of waste

c) concentration of organic matter

d) capital and operating costs.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Before composting aerobically, the empirical formula for a particular solid waste was determined as $\left(C_6H_{10}O_5\right)_7$. 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.

3. Describe the vermicomposting method for biological treatment of solid waste and mention its advantages.

4. 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.

i) Maximum rate of substrate consumption per unit mass of micro-organism (k) = 10 d^{-1}

ii) Yield coefficient (Y) = 8 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 $C_6H_{10}O_8$.

iii) 3 moles of dry solid waste give 8 moles of H_2O, 2 moles of CO, 2 moles of CO_2, 1 mole of CH_2 and 1 mole of H_2 .

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.