ENVIRONMENTAL BIOTECHNOLOGY
(BIOT 4142)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Grab sampling is a collection of air by
(a) filling an evacuated flask (b) adsorption on solids
(c) absorption in liquids (c) condensation by cold traps.

(ii) The Free available chlorine in waste water is
(a) HOCl (b) NCl_3
(c) $CHCl_3$ (d) ClO_2.

(iii) West-Gaeke colourimetric method is used to analyse
(a) Sulphur dioxide (b) Carbon monoxide
(c) Nitrogen oxides (d) Hydrocarbons.

(iv) The term biomass most often refers to _____ .
(a) inorganic matter (b) organic matter
(c) chemicals (d) ammonium compounds

(v) Threshold odour number of the water is
(a) (volume of the sample+volume of odour-free water)/volume of the sample
(b) (volume of the sample+volume of odour-free water)/volume of the odour-free water
(c) volume of the sample/(volume of the sample + volume of odour-free water)
(d) volume of odour-free water/(volume of the sample +volume of odour-free water).

(vi) Which of the following is a wet scrubber?
(a) Howard settling chamber (b) Spray tower
(c) Electrostatic precipitator (d) Typical baghouse.

(vii) Cut size in a cyclone separator is those particles that are collected with
(a) 50% efficiency (b) 25% efficiency
(c) 100% efficiency (d) 75% efficieny.

(viii) In a fixed bed adsorber, time when outlet effluent concentration become equal to that of inlet pollutant concentration is known as
(a) exit point (b) exhaustion point
(c) break-through point (d) equilibrium point.

(ix) The aerobic digestion of sewage is used to produce _____.
(a) biomass (b) bio fuels
(c) synthetic fuels (d) metal articles

(x) Bioaugmentation is a process that involves
(a) Plants usage for bioremediation (b) Bioventing
(c) Adding microbes to a cleanup site (d) Sludge removal.

Group – B

2. (a) Derive the terminal velocity ($\mathbf{V}_t$) of Howard settling chamber.

(b) Write notes on typical baghouse.

7 + 5 = 12

3. (a) Write notes on catalytic combustion unit.

(b) A cylindrical electrostatic precipitator of diameter 0.3 m is used for separating pulverized coal flyash particles from a furnace gas stream. Migration velocity of the particle is 0.12 m/s. If the volumetric flow rate of the gas is 0.05 m^3/s, what will be the length of the precipitator for obtaining a collection efficiency of 99.90 percent? What percent change in electrode collection area is required to increase the collection efficiency from 99.90 to 99.95 percent.

4 + 8 = 12

Group – C

4. (a) How can you remove the dissolved solids from water sample by reverse osmosis?

(b) Explain how oxygen demanding wastes plays an important role in water pollution.

(c) What do you mean by Sludge Volume Index?

4 + 5 + 3 =12

5. (a) How can you detect the Total Organic Carbon (TOC) from the waste water?

(b) A sample of domestic waste water has 30 mg/L of nitrogen either in the form of organic nitrogen or ammonia. Assuming that very few new cells of bacteria are formed during the nitrification of the waste, find (i) The ultimate nitrogenous oxygen demand (ii) The ratio of the ultimate NBOD to the concentration of nitrogen in the waste. Write notes on Ammonia stripping.

5 + 4 + 3 =12

Group – D

6. (a) Explain the biological steps involved in the process of anaerobic digestion.

(b) What is the necessity of multiple stage digesters for increasing the efficiency of anaerobic digestion process?

(c) Name two reactors which can be used for biogas production by anaerobic digestion process.

6 + 4 + 2 = 12

7. (a) What are the different processes for conversion of biomass to energy?

(b) Describe the process of pyrolysis.

(c) Name two biofuels that are used now-a-days in vehicles.

5 + 5 + 2 = 12

Group – E

8. (a) What are the health hazards associated with human exposure to phenolic environment?

(b) Describe any two electrochemical processes for removal of metal from wastewater.

6 + (3 + 3) = 12

9. (a) Name the electron acceptors for aerobic and anaerobic metabolism of hazardous waste by microorganism.

(b) How does the contaminant structure affects the biodegradability of a organic waste material?

6 + 6 = 12