# ENVIRONMENTAL BIOTECHNOLOGY
## (BIOT 3132)

**Time Allotted : 2½ hrs** **Full Marks : 60**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.***

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

## Group – A

1. Answer any twelve: **12 × 1 = 12**

*Choose the correct alternative for the following*

(i) In a cylindrical type electrostatic precipitator, collector surface area (A), radius of the cylinder (r) and volume of the precipitator (V) are related as
(a) A/V = r (b) A/V = 2/r
(c) A/r = 2/V (d) A*r = 2*V.

(ii) Example of wet scrubber is
(a) Packed bed tower (b) Hi-vol sampler
(c) Howard settling chamber (d) Electrostatic precipitator

(iii) Reverse osmosis is used in _____ of waste water.
(a) primary treatment (b) secondary treatment
(c) advanced treatment (d) none of the above

(iv) Production of bioethanol is through fermentation of _____ and starch components
(a) alcohol (b) sugar (c) milk (d) acid

(v) Ammonia Stripping is used in _____ of waste water.
(a) primary treatment (b) secondary Treatment
(c) advanced treatment (d) None of the above

(vi) Full form of EPA is
(a) Environmental Protocol Academy (b) Environmental Protection Agency
(c) Ecology Protection Agency (d) Ecology Protection Authority.

(vii) Which bioremediation approach involves using plants to degrade pollutants?
(a) Biopile (b) Phytoremediation
(c) Composting (d) Land farming.

(viii) End product of benzene biodegradation is
(a) acetyle CoA (b) toluene
(c) catechol (d) none of these.

(ix) Anaerobic bacteria often play important roles in bioremediation. Which of the following is not an electron acceptor used by anaerobes during biodegradation reactions?
(a) $NO^{3-}$ (b) Fe(III) (c) $H_2O$ (d) $SO_4^{-2}$

(x) In which of the following combustion technique waste is introduced to a bed of sand which is kept in suspension?
(a) Bed plate (b) Fluidised bed
(c) Incineration grate (d) Rotary.

*Fill in the blanks with the correct word*

(xi) Ultimate NBOD = 4.6 x _____.

(xii) Potassium chloroplatinate with tint of cobalt chloride is used to determine _____ of water.

(xiii) Prof. Ananda Chakraborty received the first U.S. patent for a GM entity. The organism was _____.

(xiv) Collection of air in a sampling bag is known as _____ sampling.

(xv) Usage of microbes to destroy environmental pollutants is _____.

## Group - B

2. (a) Briefly explain the different methods of collecting gaseous pollutants. *[(CO1)(Remember/LOCQ)]*

(b) A cylindrical electrostatic precipitator of diameter 0.3 m is used for separating coal flyash particles from a furnace gas stream. If the volumetric flow rate of the gas is 0.05 m3 /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 percent to 99.95 percent? Vpm for pulverized coal flyash is 0.12 m/s. *[(CO1)(Numerical/HOCQ)]*

**5 + 7 = 12**

3. (a) Analyze the carbon monoxide detection by NDIR analyzers. *[(CO1)(Analyze/IOCQ)]*
(b) Illustrate the typical adsorption break-through curve. *[(CO1)(Illustrate/IOCQ)]*
(c) Explain the process of collecting the particulate matter by tape sampler. *[(CO1)(Analyze/IOCQ)]*

**4 + 4 + 4 = 12**

## Group - C

4. (a) Analyze the working principle of trickling filter for treating the waste water. *[(CO3)(Analyze/IOCQ)]*

(b) The wastes had an ultimate BOD equal to 300 mg/L. At $20^0$C, the 5-day BOD was 200 mg/L and the reaction rate constant was 0.22/day. What would be the 5-day BOD of this waste at $25^0$C? *[(CO4)(Distinguish/IOCQ)]*

**5 + 7 = 12**

5. (a) Illustrate the primary treatment of waste water. *[(CO2)(Illustrate/HOCQ)]*
   (b) Discuss the working principle of activated sludge process in waste water treatment. *[(CO3)(Discuss/IOCQ)]*

**7 + 5 = 12**

## Group - D

6. (a) Compare among the process of incineration, gasification and pyrolysis. *[(CO4)(Analyse/IOCQ)]*
   (b) Why in modern technology of Anaerobic Digestion, two stage reactors are used instead of single digester? *[(CO5)(Apply/IOCQ)]*

**6 + 6 = 12**

7. (a) Write short note on vermicomposting. *[(CO5)(Analyse/IOCQ)]*
   (b) What should be the ideal values of C: N ratio in composting and why? *[(CO5)(Critical/HOCQ)]*

**6 + 6 = 12**

## Group - E

8. (a) Write short note on Bioventing with schematic diagram. *[(CO6)(Analyse/IOCQ)]*
   (b) Why ground water contaminated with arsenic is considered to be toxic? *[(CO6)(Analyse/IOCQ)]*

**6 + 6 = 12**

9. (a) Describe the process of :
   (i) Rhizofiltration
   (ii) Phytoextraction. *[(CO6)(Remember/LOCQ)]*
   (b) State the health hazards associated to exposure to PAH. *[(CO6)(Remember/LOCQ)]*

**6 + 6 = 12**

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| Cognition Level | LOCQ | IOCQ | HOCQ |
|---|---|---|---|
| Percentage distribution | 17.7 | 55.2 | 20.83 |

**Course Outcome (CO):**

After completing this course, students will be able to:

1. Describe different methods of sampling and controlling air pollutants.
2. Analyze the characteristics of wastewater and understand the principles of physical and chemical treatment of it.
3. Design different processes for biological treatment of wastewater and solve numerical problems related to them.
4. Explain the processes of solid waste management and apply the knowledge in waste to energy conversion.
5. Understand the principle of biodegradation and bioconversion of natural and xenobiotic compounds.
6. Apply the knowledge of bioremediation for controlling and removal of heavy metals in contaminated wastewater.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*