

**ENVIRONMENTAL BIOTECHNOLOGY**  
**(BIOT 3132)**

**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) In a fixed bed adsorber, time when the pollutant level in the exit gas stream starts to rise is known as  
(a) Exit point (b) Exhaustion point  
(c) Break-through point (d) Equilibrium point
- (ii) Flame Ionization Detector is used for analysis of  
(a) Carbon monoxide (b) Nitrogen oxides  
(c) Sulphur dioxide (d) Hydrocarbons
- (iii) Centrifugal Scrubbers is used for the removal of  
(a) Waste water (b) Gaseous air pollutant  
(c) Particulate matter (d) None of these
- (iv) The conditions for formation of Photochemical Smog are  
(a) Air stagnation  
(b) Abundant sunlight  
(c) High concentration of hydrocarbons and nitrogen oxides  
(d) All of these
- (v) The mechanism by which the particulates in a dust-laden gas are trapped on to the fibers are  
(a) Inertial Impaction (b) Direct Interception  
(c) Diffusion (d) All of the above
- (vi) What is the percentage of methane in the biogas?  
(a) 10-20 % (b) 20-40 % (c) 45-65 % (d) 55-75 %
- (vii) What is biogas composed of?  
(a) O<sub>2</sub> and CO<sub>2</sub> (b) CO<sub>2</sub> and NO<sub>2</sub>  
(c) CH<sub>4</sub> and O<sub>2</sub> (d) CH<sub>4</sub> and CO<sub>2</sub>

- (viii) Bioaugmentation involves  
(a) eliminating sludge (b) plants usage for bioremediation  
(c) addition of microbes to a cleanup site (d) bioventing
- (ix) What of the following have a major role in composting?  
(a) Bacteria (b) Fungi  
(c) Plants (d) Actinomycetes
- (x) The bioremediation process involving the usage of plants to degrade pollutants is  
(a) Composting (b) Biopile  
(c) Phytoremediation (d) Land farming

**Group - B**

2. (a) Evaluate the principle of detection of carbon monoxide by NDIR analyser.  
[[CO1] (Evaluate/IOCQ)]
- (b) Discuss the working principle of Electrostatic precipitator.  
[[CO1] (Analyse/IOCQ)]  
**6 + 6 = 12**
3. (a) A cylindrical electrostatic precipitator having a diameter of 1 m handles dust particles of 2.5  $\mu\text{m}$  in standard air with an efficiency of 99 percent. The volumetric flow rate of air is 0.2  $\text{m}^3/\text{s}$ . For an electric field strength of 1,50,000  $\text{v/m}$  and  $q_p = 1 \times 10^{-15}$  coulomb, determine the required length of precipitator.  $C = 1.168$ . [[CO1] (Illustrate/HOCQ)]
- (b) Discuss the various methods of collecting gaseous air pollutants.  
[[CO1] (Discuss/IOCQ)]  
**6 + 6 = 12**

**Group - C**

4. (a) What do you mean by NBOD? [[CO2] (Remember/LOCQ)]
- (b) Illustrate the process of sludge treatment and disposal. [[CO2] (Illustrate/HOCQ)]  
**3 + 9 = 12**
5. (a) Derive the equation of finding out BOD of a waste in a seeded dilution water?  
[[CO2] (Derive/HOCQ)]
- (b) Design the working principle of Trickling filter. Give diagram.  
[[CO3] (Design/IOCQ)]  
**7 + 5 = 12**

**Group - D**

6. (a) Analyze the optimum process conditions for vermicomposting?  
[[CO4] (Analysis/IOCQ)]
- (b) What types of wastes are suitable for pyrolysis process?  
[[CO4] (Remember/LOCQ)]

- (c) What is the major product of fast pyrolysis process? Justify its production. [(CO4) (Analyze/IOCQ)]  
 $5 + 4 + (1 + 2) = 12$

7. (a) Outline the method of landfarming process. [(CO4) (Understand/LOCQ)]  
(b) How do soil characteristics affect the landfarming process? [(CO4) (Analyze/IOCQ)]  
(c) Do anaerobic digesters reduce greenhouse gas emissions? [(CO4) (Critique/HOCQ)]  
 $4 + 4 + 4 = 12$

**Group - E**

8. (a) Define (i) Phytoextraction (ii) Rhizofiltration. [(CO4) (Remember/LOCQ)]  
(b) Give a comparative analysis between biostimulation and bioventing. [(CO5) (Differentiate/IOCQ)]  
(c) Name any two POP .Draw their structure. [(CO4) (Remember/LOCQ)]  
 $(2 + 2) + 6 + 2 = 12$
9. (a) Define PAHs? Highlight on the sources of PAHs. [(CO5) (Remember/LOCQ)]  
(b) Discuss the principle of heavy metal removal by bio-precipitation with suitable diagram. [(CO6) (Analyze/IOCQ)]  
(c) What are the common sources of heavy metal mercury contamination in environment. [(CO6) (Remember/LOCQ)]  
 $5 + 5 + 2 = 12$

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	23 %	50%	27%

**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

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<b>Department &amp; Section</b>	<b>Submission Link</b>
<b>BT</b>	<a href="https://classroom.google.com/c/NDU00TAyODgyMTQ2/a/NDU00TAyODgyMTc3/details">https://classroom.google.com/c/NDU00TAyODgyMTQ2/a/NDU00TAyODgyMTc3/details</a>