

**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) Baghouse is used for removal of  
(a) Waste water  
(b) Gaseous air pollutant  
(c) Particulate matter  
(d) None of these.
- (ii) Sludge Volume Index for a good sludge is  
(a) Less than 40  
(b) 40-100  
(c) 100-200  
(d) More than 200.
- (iii) Infra red radiation is absorbed by  
(a) Sulphur dioxide  
(b) Hydrocarbons  
(c) Nitric oxides  
(d) Carbon monoxide.
- (iv) Trickling Filter is used in \_\_\_\_\_ of waste water.  
(a) Primary Treatment  
(b) Secondary Treatment  
(c) Advanced Treatment  
(d) None of the above
- (v) Waste water treatment which mainly reduces the Nitrogen and Phosphorus from water is known as  
(a) Primary Treatment  
(b) Secondary Treatment  
(c) Advanced Treatment  
(d) All of these.
- (vi) In which method of disposal, municipal solid waste is dumped on soil  
(a) Incineration  
(b) Composting  
(c) Land filling  
(d) Shredding.
- (vii) \_\_\_\_\_ is a liquid that passes through solid waste and extracts suspended impurities from it.  
(a) Leachate  
(b) sludge  
(c) Distilled water  
(d) Municipal waste
- (viii) Anaerobic bacteria often play important roles in bioremediation. Which of the following is not an electron acceptor used by anaerobes during biodegradation reactions?  
(a)  $\text{NO}_3^-$   
(b)  $\text{Fe(III)}$   
(c)  $\text{H}_2\text{O}$   
(d)  $\text{SO}_4^{2-}$ .

- (ix) What is biomass energy?  
(a) Energy generated from wind  
(b) Energy generate from river  
(c) Energy generate from ocean waves  
(d) Energy generate from plant and animal.
- (x) Phenol based xenobiotics are converted into \_\_\_\_\_  
(a) Catechol                      (b) Sulphur                      (c) Acrylamide                      (d) Acid.

**Group - B**

2. (a) A conventional cyclone with diameter 1 m handles 3 m<sup>3</sup>/s of standard air. Using  $Ne = 6$ , determine the cut size of particles of density 1500 kg/m<sup>3</sup>.  $\mu_g = 1.8 \times 10^{-5}$  kg/m-s.  
[[CO1](Numerical/HOCQ)]
- (b) Illustrate the process of separating the particulate matter from the gaseous sample by Baghouse.  
[[CO1](Illustrate/IOCQ)]
- 6 + 6 = 12**
3. (a) How can you analyse the hydrocarbons by Flame Ionisation Detector?  
[[CO1](Analyze/IOCQ)]
- (b) A multitray settling chamber handles 6 m<sup>3</sup>/s of air at 20 °C. There are 8 trays including the bottom surface, spaced 0.25 m apart. The chamber is 4 m long and 1 m wide. For particles of density 2000 kg/m<sup>3</sup> and sizes 25 µm, calculate the efficiency of collection, distance settled and residence time. Assume Laminar Flow.  $\mu_g = 1.8 \times 10^{-5}$  kg/m-s.  
[[CO1](Calculate/HOCQ)]
- 6 + 6 = 12**

**Group - C**

4. (a) Outline the factors on which the BOD reaction rate constant depends.  
[[CO2](Remember/LOCQ)]
- (b) Write notes on (i) Ammonia Stripping (ii) Rotating Biological Contactor.  
[[CO2,CO3](Discuss/LOCQ)]
- 4 + (4 + 4) = 12**
5. (a) Explain how heat plays an important role in water pollution.  
[[CO3](Explain/LOCQ)]
- (b) Describe the different air supply and process modifications of conventional activated sludge system.  
[[CO3](Describe/HOCQ)]
- 5 + 7 = 12**

**Group - D**

6. (a) Draw a flowsheet to describe the routes of energy production from biomass. Describe each of the routes in brief.  
[[CO5](Describe/HOCQ)]

(b) Name the major products obtained in slow pyrolysis process.

[(CO5)(Remember/LOCQ)]

(4 + 5) + 3 = 12

7. (a) Explain how does temperature of the aerobic composting process change with the time of progress of composting? [(CO4)(Explain/IOCQ)]

(b) Mention three important factors which influence the efficiency of composting. Also explain how they affect the process. [(CO4)(Explain/HOCQ)]

6 + 6 = 12

### Group - E

8. (a) Write short notes on Bioaugmentation. [(CO6)(Illustrate/IOCQ)]

(b) State the reason: Xenobiotic compounds may exhibit recalcitrant nature.

[(CO5)(Analysis/IOCQ)]

6 + 6 = 12

9. (a) Describe the pathway for aerobic biodegradation of phenol. [(CO5)(critical/HOCQ)]

(b) What is POP? Highlight on the common sources of them. [(CO6)(Remember/IOCQ)]

6 + 6 = 12

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	20.83	37.5	41.67

### 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.

