

**M.TECH/BT/1<sup>st</sup> SEM/BIOT 5132/2017**  
**ADVANCED ENVIRONMENTAL BIOTECHNOLOGY**  
**(BIOT 5132)**

**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) The term recalcitrant is primarily related to  
(a) its ability to get accumulated in living systems  
(b) its ability to mix up with soil  
(c) its persistence in nature  
(d) its extent of toxicity to living system.
- (ii) Atrazine belongs to the group  
(a) organochlorine pesticides  
(b) organophosphate pesticides  
(c) carbamate pesticides  
(d) both organophosphorous and carbamate pesticides.
- (iii) The micro-organism used in bioleaching of several minerals is  
(a) *Acetobacter vinelandii* (b) *Acidithiobacillus ferrooxidans*  
(c) *Aspergillus niger* (d) *Bacillus subtilis*.
- (iv) Which is the correct flow process for biogas production by anaerobic digestion?  
(a) Hydrolysis → Acidogenesis → Acetogenesis → Methanogenesis  
(b) Hydrolysis → Acetogenesis → Acidogenesis → Methanogenesis  
(c) Acidogenesis → Hydrolysis → Acetogenesis → Methanogenesis  
(d) Acidogenesis → Acetogenesis → Hydrolysis → Methanogenesis
- (v) Which of the following statements is NOT true?  
(a) The volatile matter in the biomass contains more energy.  
(b) Silviculture is the process of rearing silkworms.  
(c) Exploitative method is a type of deforestation.  
(d) Aquatic biomass exhibit higher net organic yield than terrestrial biomass.

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- (vi) Biostimulation means  
(a) addition of microbes to a ground for better degradation of organic pollutants  
(b) addition of water, oxygen and nutrients for better degradation of organic pollutants  
(c) addition of microbes, water, oxygen and nutrients for better degradation of organic pollutants  
(d) natural degradation of organic pollutants by microbes.
- (vii) Minamata and Itai Itai diseases are associated with  
(a) arsenic and cadmium (b) arsenic and mercury  
(c) chromium and cadmium (d) mercury and cadmium.
- (viii) Cytochrome p450 is useful for degradation of toxic compounds because  
(a) it possesses monooxygenase and dioxygenase enzymes  
(b) it conducts electron transport chain  
(c) it produces ATP  
(d) it possesses carboxylase enzyme.
- (ix) A pollutant can act as a primary substrate  
(a) when it supports growth of an organism in absence of another substrate  
(b) when it supports growth of an organism in presence of glucose  
(c) when it supports growth of an organism in presence of any other substrate  
(d) when it supports growth of an organism in presence of at least two more substrates.
- (x) Ex situ bioremediation involves  
(a) direct degradation of pollutants by microbes  
(b) collection of pollutants, their transfer to another site and degradation by microbes  
(c) degradation of pollutants by aerial oxygen  
(d) collection of pollutants, their transfer to another site and degradation by excess oxygen.

**Group - B**

2. (a) Write the chemical forms of arsenic that are found in nature. State the most abundant and the most toxic form of arsenic.  
(b) To check whether a population has arsenic exposure, hair and nail samples are usually tested. Explain the practice.  
(c) Discuss the mechanism by which arsenic can cause oxidative damage.

**(2 + 2) + 4 + 4 = 12**

3. (a) Classify pesticides according to their chemical structure. Discuss the mode of action of DDT-type pesticides and alycyclic chlorinated pesticides.
- (b) A group of people residing in a city were suddenly started suffering from difficulty in limb movements. Upon investigation, they seemed to consume fruits and vegetables contaminated with the pesticide sumithione. Correlate the two observations.

$$2 + 3 + 3 + 4 = 12$$

**Group - C**

4. (a) How can precipitation be used for treating industrial effluent?
- (b) Discuss application of any one membrane separation process to treat industrial waste water.

$$6 + 6 = 12$$

5. Compare all the four different solid waste disposal methods and conclude which method in your opinion is the best. Justify your choice.

$$8 + 1 + 3 = 12$$

**Group - D**

6. (a) Justify the following statements.
- (i) Biotransformation makes mercury more toxic.
- (ii) Mixed bacterial culture is better than a pure culture for treatment of organic pollutants.
- (iii) A bacterial strain with high mono-oxygenase activity is likely to be useful for degradation of persistent organic pollutants.

$$(2 + 4) + (2 + 4) = 12$$

7. (a) You want to have a bacterial culture from soil that is resistant to mercury. Which site will you choose for your sample collection? (i) urban park, (ii) near petrol pump, (iii) near paper mill. Justify your answer.

- (b) Discuss land farming and biopilling for treatment of contaminated soil.

$$5 + (4 + 3) = 12$$

**Group - E**

8. (a) Enumerate different sources of biomass used to produce energy.

- (b) Justify the usage of biomass as a source of energy.
- (c) What are energy crops? Give examples.

$$5 + 4 + (2 + 1) = 12$$

9. (a) What is Simpson's Diversity Index? Work out the value of Simpson's Diversity Index.

The following specimens were collected from Area 1

Order	Description	Number of individuals (n)
Orthoptera (grasshopper)	green with red legs	6
Orthoptera (grasshopper)	brown with a yellow stripe	5
Lepidoptera (butterfly)	large, blue	1
Lepidoptera (butterfly)	small, blue	3
Coleoptera (beetle)	red and blue	12

And the specimens collected from Area 2 are as follows-

Order	Description	Number of individuals (n)
Hymenoptera (wasp)	black	12
Hymenoptera (wasp)	purple	21
Hymenoptera (bee)	striped	5
Orthoptera (grasshopper)	green with red legs	25
Orthoptera (grasshopper)	brown with a yellow stripe	2
Lepidoptera (butterfly)	large blue	17
Lepidoptera (butterfly)	small blue	9

Infer statistically which area is more diverse?

**12**