ADVANCED ENVIRONMENTAL BIOTECHNOLOGY
(BIOT 5142)

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 chemical species that belong to ROS group include
(a) Superoxide, peroxy and hydroxyl radicals
(b) Superoxide radical and hydroxide ion
(c) Hydrogen peroxide only
(d) Hydrogen peroxide and hydroxide ion

(ii) The name Chisso chemical is associated with
(a) Minamata disease (b) Itai Itai disease
(c) Bhopal disaster (d) Chernobyl disaster

(iii) Find the odd one out
(a) *Saccharomyces cerevisiae* (b) Ethanol production
(c) Fuel oil (d) Biogas

(iv) Which of the following statement is correct for biodegradation of organic pollutants?
(a) Biodegradation of n-alkane is catalyzed by mono-oxygenase
(b) Straight chain compounds are more difficult to degrade than ring compounds
(c) All microbes can degrade aliphatic hydrocarbons
(d) Unsaturated organic compounds cannot be degraded by bacteria.

(v) Which of the following statement 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.

(vi) In ethanol production by alcoholic fermentation, the conversion of dextrin to glucose is known as
(a) Saccharification (b) Liquefaction
(c) Partial hydrolysis (d) All the above

(vii) A diversity index is
(a) a mathematical measure of species diversity in a given community
(b) based on species richness and abundance
(c) measured by Shannon index
(d) All the above

(viii) Which of the following is NOT a waste disposal method?
(a) Open dumping (b) Sanitary landfill
(c) Composting (d) Block collection

(ix) Biostimulation refers to
(a) Addition of microbes to contaminated sites
(b) Addition of microbes to a bioreactor
(c) Addition of nutrients to a contaminated site
(d) Addition of oxygen to a reactor

(x) 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

Group – B

2. (a) Define the terms with respect to the toxicity of xenobiotics:
(i) accumulation,
(ii) biotransformation

(b) Discuss the acute toxicity mechanisms for simple asphyxiants and chemical asphyxiants.

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

3. (a) Arsenic contamination became a problem in West Bengal when a large number of tube wells were constructed for safe drinking water. Give your opinion on this.

(b) Discuss the fate of arsenic in human body after it is consumed.

(c) Discuss the mechanism of arsenic induced carcinogenicity.

3 + 4 + 5 = 12

Group – C

4. (a) How is biodiesel produced from vegetable oils?

(b) Write a short note on electrodialysis.

7 + 5 = 12

5. (a) Write a detailed account of treatment of waste water by precipitation method.

(b) What are the methods of collection of solid waste?

7 + 5 = 12

Group – D

6. (a) A bacterial species can grow in presence of mercuric chloride but not in methyl mercury. Explain the above observation.

(b) Discuss the role of mer R, mer P and mer D genes in the mer operon.

6 + 6 = 12

7. Read the following case of bioremediation of an oil contaminated site and answer the questions.

A group of scientists from TERI successfully did bioremediation of IOCL sites contaminated with oily wastes. The steps they followed are given below.

The researchers took samples soil samples from petroleum contaminated sites near oil refineries. They suspended the soil samples in minimal salt media (MSM) with crude oil as the carbon source and subcultured them 5 times in the same media for enrichment.

Oil degrading bacterial strains were isolated. The researchers checked the crude oil degrading capacity of each individual isolates and prepared consortia based on degradation ability and environmental growth parameters.

The researchers applied a consortium over oily waste by manual spreading at intervals of one month. Specially formulated nutrient-mix containing nitrogen (N), phosphorous (P) and potassium (K) was applied on the site. The oily waste and microbes were mixed with soil by tilting.

Soil quality was monitored after each month. After several months, the site was found to be free from contamination.

(i) What do you mean by oily waste? State the composition of the oily waste.
(ii) Why the researchers collected soil from oil refinery sites to get the useful bacteria?
(iii) Why the researchers subcultured the bacteria for 5 times at the beginning of the experiment?
(iv) Why the researchers added nutrient mix to the soil?
(v) Can you suggest a parameter the researchers might have tested to check the remediation of soil?

(1 + 2) + 3 + 2 + 3 + 1 = 12

Group – E

8. How are minerals extracted from their ores using microbial technology?

12

9. Area 1 was sampled and the following specimens were collected.

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

These are the specimens collected from Area 2.

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

Department & Section	Submission Link
BT	https://classroom.google.com/c/MjQ1Njc5OTE1ODgx/a/MjkyNTA1NzI1ODMy/details