M.TECH/BT/1ST SEM/BIOT 5142/2021

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) Phosphate in waste water reacts with lime to form
(a) Calcium carbonate (b) Calcium bicarbonate
(c) Calcium hydroxyapatite (d) Calcium hydroxide

(ii) Which of the following is not a composting technique?
(a) Bangalore process (b) Indore process
(c) Kolkata process (d) Buhler process

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

(iv) The main component of biogas is
(a) Hydrogen (b) Nitrogen
(c) Methane (d) Hydrogen sulphide.

(v) The micro-organism NOT used in bioleaching of minerals is
(a) Acidithiobacillus thiooxidans (b) Acidithiobacillus ferrooxidans
(c) Desulfovibrio (d) Bacillus subtilis

(vi) What is a persistent organic pollutant
(a) A carbon-based chemical that exists in nature for a long time
(b) B) a salt of heavy metals
(c) An arsenic-based compound that exists in nature
(d) A group of nitrogen-based compounds

(vii) Pyrethrin is obtained from
(a) Azadirachta indica (b) Utricia dioca
(c) Tagetus erecta (d) Chrysanthemum cinerariofolium

(viii) Itai Itai disease is associated with
(a) Arsenic toxicity (b) Pesticide toxicity
(c) Cadmium toxicity (d) Mercury toxicity

(ix) Ex situ bioremediation involves
(a) Degradation of organic compounds by bacteria on the site
(b) Removal of polluted soil, collection at a place and degradation by bacteria
(c) Degradation of pollutants by genetically modified organisms
(d) Degradation of pollutants by chemical processes

(x) Bioaugmentation is
(a) Addition of microbes to the contaminated site
(b) Addition of nutrients to the contaminated site
(c) Addition of water to the contaminated site
(d) Addition of air to the contaminated site

Group – B

2. (a) What are reactive oxygen species? Reactive oxygen species are often associated with the cellular damage by xenobiotic compounds. Discuss the mechanism by which the damage is done. [(CO1) (Understand, LOCQ)
(b) Suggest some reasons for which most bacteria cannot degrade petrochemical products. [(CO1) (Analyze/IOCQ]

(2 + 4) + 6 = 12

3. Minamate disease occurred in Japan in mid 1950s with the first case being reported in 1956. Symptoms of the disease included difficulty in moving fingers, difficulty in movement, cramp, loss of memory, unsteadiness etc. Research teams were formed in Kumamoto University School of Medicine. They found that the disease is closely associated with consumption of fishes and shellfishes from Minamata Bay. Chisso Chemicals, an acetaldehyde-producing industry that used inorganic mercury as the catalyst was suspected to be responsible for this. Researchers hypothesized that the disease was caused by organomercury compounds. With this information, answer the following.
(i) Apart from organomercury compounds, what are the other forms of mercury found in nature? [(CO1) (Remember/LOCQ)]
(ii) Correlate the symptoms with the toxic effect of mercury. [(CO1) (Analyze/IOCQ)]
(iii) Chisso Chemicals used to dispose mercury containing effluents into water. Discuss how mercury gets accumulated in fish from water. [(CO1) (Understand/LOCQ)]
(iv) Chisso Chemical argued that they could not isolate organomercury compounds from the muscles of cat fed with fish and shellfish from Minamata Bay. Give a counter argument to their statement. [(CO1)(Argument/HOCQ)]

(2 + 3 + 3 + 4) = 12

Group - C

4. Compare all the four different solid waste disposal methods and conclude which method in your opinion is the best. Justify your choice. [(CO3) (Justify/HOCQ)]

(8 + 1 + 3) = 12

5. (a) Explain in detail the process employed to remove hardness of drinking water. [(CO2) (Analyze/IOCQ)]
   (b) Write a short note on electrodialysis. [(CO2)(Description/LOCQ)]

7+ 5 = 12

Group - D

6. (a) Describe the pathway for degradation of phenol. [(CO3) (Analyse/IOCQ)]
   (b) A group of researchers reported higher rate of phenol degradation at higher flow rate of oxygen in a reactor. Give a possible explanation of the observation. [(CO3) (Critique/HOCQ)]
   (c) Find out which of the following sites is best suitable for finding a hydrocarbon degrading organism and justify your choice. i) agricultural field, ii) petroleum industry, iii) urban entertainment park. [(CO2) (Justify/HOCQ)]

4 + 4 + 4 = 12

7. Compare the biodegradation and bioremediation of oil between i) Exxon Valdez Oil Spill and ii) BP Deep Water Oil Spill, considering the following points.
   (i) Nature and site of the oil spill
   (ii) Major challenges
   (iii) Strategies. [(CO4) (Analyze/ IOCQ)]

(4 + 4 + 4) = 12

Group - E

8. (a) Work out the value of Simpson's Diversity Index, **D,** for a single quadrat sample of ground vegetation in a woodland from the given data:

Species	Number (n)
A	81
B	2
C	2
D	2
E	1
Total (**N**)	

[(CO4) (Evaluate/IOCQ)]

(b) Define Shannon's diversity index and Shannon's equitability. [(CO3) (Remember/LOCQ)]

8 + 4 = 12

9. (a) Enumerate different sources of biomass used to produce energy. [(CO4) (Remember/LOCQ)]
(b) Justify the usage of biomass as a source of energy. [(CO4) (Analyze/IOCQ)]
(c) What are energy crops? Give examples. [(CO4) (Remember/LOCQ)]

4 + 4 + (2 + 2) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	29.17%	45.83%	25%

Course Outcome (CO):

At the end of this course:

1) Understand the of the cause and effect of environmental pollution in details
2) Explain the conventional processes of waste treatment
3) Interpret the role of microbes in pollution control
4) Develop biotechnological process for waste treatment
5) Recognize the importance of biodiversity
6) Comprehend the concept of green technology

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

Department & Section	Submission Link
BT	https://classroom.google.com/c/NDI5ODc2NzQ4MDc0/a/NDc0ODQxNDQwMjM0/details