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) Which one is true for DDT?
(a) A non pollutant (b) An antibiotic
(c) An antiseptic agent (d) A non-degradable pollutant.

(ii) Pyrethrum is obtained from
(a) Azadirachta indica (b) Ocimum sanctum
(c) Chrysanthemum cinerariifolium (d) Tagetes erecta.

(iii) Ars C is a protein that represents
(a) Arsenate reductase (b) Arsenite pump
(c) Arsenate trasporter (d) Repressor for ars operon.

(iv) The class of enzyme most important for degradation of hydrocarbons under aerobic condition is
(a) Mono-oxygenase and d-oxygenase (b) Dehydrogenane
(c) Lipase (d) Reductase.

(v) The process of collection of volatile component to condense them to produce a liquid fuel or bio-oil is called
(a) pyrolysis (b) composting (c) liquefaction (d) solvolysis.

(vi) To regenerate a cation resin it should be washed with
(a) HCl (b) NaCl
(c) NaOH (d) any of the above.

(vii) In sanitary landfill technique the biological activity occurs in the following order
(a) aerobic, methanogenic, anaerobic
(b) aerobic, anaerobic, methanogenic
(c) methanogenic, anaerobic, aerobic
(d) methanogenic, aerobic, anaerobic.

(viii) Nitrosomonas bacteria converts
(a) NH^{4+} to NO_2^- (b) NO_2^- to NO_3^-
(c) NH^{4+} to NO_3^- (d) none of the above.

(ix) Ethanol production by alcoholic fermentation is facilitated by
(a) Saccharomyces cerevisiae (b) Aspergilus niger
(c) E.coli (d) Acidithiobacillus ferrooxidans.

(x) Which is not true for reverse osmosis?
(a) Demineralization of water
(b) Semi-permeable membrane
(c) External pressure applied is less than the osmotic pressure
(d) External pressure is applied to the concentrated region.

Group – B

2. (a) State how the following substances exert their toxic effects. (i) Polyaromatic hydrocarbons, (ii) mercury, (iii) synthetic pyrethroids.

(b) Discuss the genotoxicity caused by chromium (VI).

(3 × 3) + 3 = 12

3. (a) Write the chemical form of arsenic that is commonly found in drinking water. Discuss the mechanism of toxicity of arsenic.

(b) Old houses with oil paintings are often found to have indoor pollution with lead. Explain the observation. Anemia caused by lead toxicity cannot be cured by iron supplementation. Do you agree with the statement? Justify your answer.

(1 + 5) + (3 + 3) = 12

Group – C

4. A feed solution at 25°C contains 3500mg NaCl/L. The permeability constant $K_p = 3.5 \times 10^{-4}$kg solvent/(s.m^2.atm) and $K_p' = 2.5 \times 10^{-7}$m/s. Using a ΔP = 35.5atm and π = 1.937atm, calculate the fluxes, solute rejection, R, and product solution concentration in mg NaCl/L.

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5. (a) How is microbial technology used for waste water treatment? What is BOD?

(b) Write a short note on chelation.

(8 + 1) + 3 = 12

Group – D

6. (a) Discuss the role of peptidoglycans and extracellular polysaccahrides for removal of lead by microbes.

   (b) Discuss oxidative dehalogenation, hydrolytic dehalogenation and reductive dehalogenation for degradation of chlorinated hydrocarbons.

6 + (2 × 3) = 12

7. (a) State the differences between Exxon Valdez oil spill and BP Deepwater oil spill in terms of nature of accident and environmental condition.

   (b) Discuss the treatment methods for recovery of the two sites.

6 + 6 = 12

Group – E

8. (a) What is anaerobic digestion? Describe the process of biogas production by anaerobic digestion.

   (b) What is bioenergy? Can it be termed as renewable energy? Justify your answer.

(2 + 6) + (1 + 1 + 2) = 12

9. (a) Work out the value of Shannon's Index, H_s, for a single quadrat sample of ground vegetation in a woodland from the given data:

Species	Number (n)
Woodrush	8
Holly (seedlings)	10
Bramble	3
Yorkshire Fog	3
Sedge	6
Total (N)	30

   (b) Define Simpson's diversity index.

9 + 3 = 12