**ENVIRONMENTAL MICROBIAL BIOTECHNOLOGY (MICR 307) 2014**

**TUTORIAL 4**

1. Write short notes on the following;

 (i) *In situ* bioremediation (ii) Biostimulation

 (iii) Bioaugmentation (iv) Phytoremediation

 (v) Composting (vi) Bioventing

 (vii) *Ex situ* bioremediation (viii) Biosparging

 (ix) Biopiles (x) Phytomining

1. What are the relative advantages and disadvantages of bioremediation over the other conventional techniques used for remediation of contaminated soil and groundwater?
2. List five different classes of contaminants potentially suitable for bioremediation, giving specific examples and their potential sources.
3. Describe the major groups of microorganisms suitable for bioremediation process and discuss three important factors necessary for the process to take place.
4. Discuss the impacts of nutrients availability and optimum environmental conditions on bioremediation processes.
5. Provide an overview of the various bioremediation strategies (both *in situ* and *ex situ*), identifying the benefits and limitations of the various strategies.
6. Phytoremediation is an emerging technology that uses plants to remove contaminants from soil and water:
	1. Provide an overview of the various types of phytoremediation techniques, based on the contaminant fate.
	2. Outline five advantages and five limitations of phytoremediation as an option for remediating contaminated soil and water.

8. Phytomining describes the exploitation of sub-economic ore bodies using plants. Using specific examples, discuss the unique features and applications of this technique.

1. Halogenated compounds are an extremely important and

 diverse class of environmental chemicals.

* 1. Discuss the four major microbial processes involved in their degradation.
	2. Discuss the role of microorganisms in the degradation of the different classes of this compound, providing specific examples in each case.
	3. Discuss the importance of dehalogenase enzymes in the microbial degradation of this group of compounds.

10. Using specific examples, describe briefly the reductive dehalogenation of chlorinated organics, providing the reductive dehalogenases involved.