Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: BIOREMEDIATION [BIO 4001]

REVISED CREDIT SYSTEM
(25/11/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A.	Percolation, as a means of in situ remediation of aquifers, has an inherent disadvantage during heavy rains. What is the associated problem?	**2m**
1B.	If coal was to be gasified in a bio-based manner, what strategy would you adopt? What are the different types of products that could be obtained?	**4m**
1C.	Describe any two approaches for the phytoremediation of soil contaminated with toxic metal wastes.	**4m**
2A.	At one point of time, the Great Lakes in North America experienced elevated rates of eutrophication. Analyses pointed out to the higher inflows of biodegradable detergents. Suggest a simple step to avert this problem.	**2m**
2B.	A land treatment unit is designed for the reclamation of soil contaminated with polyaromatic hydrocarbons. What measures need to be taken for efficient sampling of soils for periodic monitoring of contaminant levels?	**3m**
2C.	Consider the metabolism of raffinose by aerobic bacteria, for the redox pairs CO_2/raffinose and O_2/H_2O. Write the half reactions and the combined balanced reactions. Find the free energy for this reaction if the redox potential values for O_2/H_2O is +0.82V and that for $CO_2/C_{18}H_{32}O_{16}$ is –0.43V.	**5m**

3A.	A soil sample, 1000 cm^3, has a porosity of 0.25, a wet bulk density of 2.14 g/cm^3, and a moisture content of 7.9% by weight. (a) What is the particle density of the soil? (b) What is the volumetric moisture content of the soil? (c) What volume of water would need to be added to the soil to bring it to 95% saturation?	**3m**
3B.	Present a schematic diagram showing a biofiltration unit with nutrient recycle system, for microbial gas cleaning.	**3m**
3C.	How is the screening of contaminants done in the air sparging unit designed for in situ remediation of water bodies, underneath the surface of earth? What are the associated methods for screening the contaminants?	**4m**
4A.	Land treatment has been chosen as the bioremediation process to treat soil from an abandoned wood-treating facility contaminated with p-cresol (MW: 108.14 g/mol) and pentachlorophenol (MW: 266.34 g/mol). The volume of soil to be excavated for treatment is ≈ 6500 m^3. A 15700 m^2 LTU is constructed for remediation purposes. If the soil is a mixture of silty clay and sandy clay, estimate the number of lifts that should be applied, and the appropriate soil depth for each lift in cm.	**4m**
4B.	An accident at an industrial site involves toluene spillage. The site is subjected to bioremediation using microbes acclimatized to the contaminants. What would be the most probable pathway taken by the microbes during the degradation steps? Explain with chemical structures.	**6m**
5A.	Describe the first four phases in the process cycle of a sequencing batch reactor for slurry-phase treatment of contaminated soil.	**4m**
5B.	Moisture and pH can have a profound role in influencing microbial growth and contaminant biodegradation. Justify. When these two parameters go out of range, what methods are adopted to bring them to normal values?	**6m**