Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent institution of MAHE, Manipal)

VII SEMESTER B.TECH. (BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, Nov/Dec 2018

SUBJECT: BIOREMEDIATION [BIO 4001]

REVISED CREDIT SYSTEM

Time: 3 Hours **29.11.2018** **MAX. MARKS: 50**

Instructions to Candidates:

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

1A.	How is a chemoorganoheterotroph different from a photoautotrph?	***2***
1B.	Analyse why redox-based reactions hold prime importance in bioremediation strategies?	***4***
1C.	Consider an alkene with 5 carbon atoms. Show the different reaction schemes by which the alkene can be microbially degraded.	***4***
2A.	Determine the volume of a xenobiotic compound required to exceed the drinking water MCL of 7.5 µg/L in 1 L of water and the volume of water that can be contaminated by 1 L of TCE. The density of that pure compound at 25ºC may be taken as 2.13 kg/L.	***2***
2B.	When is a sequencing batch reactor made use of? Write one line each about the different phases of the reactor operation.	***4***
2C.	Land treatment has been chosen as the bioremediation process to treat soil from an abandoned wood-treating facility contaminated with PAHs. The volume of soil to be excavated for treatment is ≈ 10000 m^3. A 57000 m^2 LTU is constructed for remediation purposes. If the soil is a mixture of silty clay and sandy clay, estimate the no. of lifts that should be applied, and the appropriate soil depth for each lift in cm.	***4***
3A.	A soil core, collected from the field, has a bulk volume of 150 mL, an air volume of 43 cm^3, a wet mass of 175 g, and a dry mass of 140 g. Calculate the total porosity and the bulk density.	***3***
3B.	Draw the labelled schematic of a bioventing unit.	***3***
3C.	What is the difference between air sparging and soil vapour extraction? Explain, in terms of, the process and when these methods are preferred.	***4***

4A.	Discuss on any three environmental factors that influence microbial growth and contaminant biodegradation?	***5***
4B.	Consider the metabolism of maltose by aerobic bacteria, for the redox pairs CO_2/maltose 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 +0.73V and that for $CO_2/C_{12}H_{22}O_{11}$ is –0.32V.	***5***
5A.	When is percolation, a method of choice of remediation? Explain the process and the problems involved, with a labelled schematic.	***5***
5B.	What is BTEX and why is it popular among bioremediation scientists? Explain, with any one example, the reaction mechanism by which they are degraded.	***5***