MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. END SEMESTER EXAMINATIONS

DECEMBER 2020

SUBJECT: BIOREMEDIATION [BIO 4001]

Date of Exam: **30/12/2020** Time of Exam: **9.00 am to 12.00 noon** Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitable assumed

1A.	What is the significance of the electron tower concept?	**2**
1B.	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 estimated at 16000 m3. A 16690 m2 land treatment unit has been constructed for this purpose. If the soil is fully devoid of clayey particles, estimate the number of lifts that should be applied, and the appropriate soil depth for each lift in centimeters.	**4**
1C	Describe a method of vapour phase bioremediation with a labelled schematic.	**4**
2A.	What do you understand by methylotrophs? Where are they employed?	**3**
2B.	Production of hydrogen sulphide in paper mills and tanneries is an environmental problem. The related sewage distribution systems get corroded rapidly. Formulate a simple cost-effective strategy to alleviate this problem.	**3**
2C.	How do substrate and microbiological factors affect microbial growth and biodegradation?	**4**
3A.	What is meant by phytoremediation? What are the major classifications?	**2**
3B.	Although polycyclic aromatic hydrocarbons have usually been found to persist under strict anaerobic conditions, an unusual site was found near Bombay High in which naphthalene and phenanthrene were oxidized to carbon dioxide. Propose a mechanism, how this could have been possible.	**4**
3C.	Certain standard models have been devised for studying the kinetics of substrate biodegradation. Analyze what must be the factors considered before choosing a specific model for a specific bioremediation strategy.	**4**
4A.	What are the major steps in the biodegradation of an aromatic compound.	**3**
4B.	Explain, in detail, the working of a sequencing batch reactor, with a labelled schematic.	**7**

5A.	During pilot-scale studies performed for degrading of methyl tert-butyl ether (MTBE), researchers find that it takes more than an year of acclimation period to achieve more than 95% removal efficiency. They based their study on average inlet concentrations of 200 ppb. Analyze the reason for the recalcitrant nature of MTBE.	**2**
5B.	What would be the free energy change when fumarate is completely metabolized by aerobic microbes? Compare it with the case when glucose is used as the energy source. Present the half-reactions and the combined balanced reaction, for both the cases. It is given that the RP values for the redox pairs $CO_2/C_4H_4O_4$, $CO_2/C_6H_{12}O_6$ and O_2/H_2O are (-) 0.27 V, (-) 0.43 V and (+) 0.82 V, respectively. Comparing the two values of free energy, what is your conclusion?	**8**