Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IISEMESTER M.TECH (INDUSTRIAL BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, MAY 2017 (REGULAR)

BIO5247- DESIGN AND DEVELOPMENT OF BIOLOGICAL TREATMENT PROCESSES

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Explain the following terms that are used in the design of biological treatment processes: (i) MLSS (ii) MLVSS (iii) F/M ratio	**3**
1B.	When do you recommend orbal process for the treatment of wastewater? Explain the orbal process that is used for treatment of industrial wastewater.	**4**
1C.	When do you recommend conventional extended aeration activated sludge process? Explain about this process for the treatment of wastewater.	**3**
2A.	With a flow diagram explain the mass and energy balances for anaerobic glucose degradation.	**3**
2B.	With a flow diagram explain the aerobic degradation of Lipids and natural fats.	**4**
2C.	Explain various techniques used for removal of Xenobiotics from wastewater.	**3**
3A	Design the following activated sludge system for the treatment of wastewater (BOD removal) as a plug flow. Data: μ_m=2.5d^{-1}, K_d=0.05 d^{-1}, Y=0.5, K_s=100 g/l, Q=12960 m^3/d, Influent BOD= 84 mg/l, Effluent BOD= 11.1 mg/l, X=3000 mg/l Find: a. The cell mean residence time for desired BOD removal process (θ_C) b. Hydraulic residence time (θ) c. Total sludge to be discarded in the above process d. Air requirement during above process	**6**
3B.	Design the secondary clarifier for Activated sludge process with the following specifications. Influent wastewater flow rate (Q_0)=12960 m^3/d, Sludge discard flow rate (Qw)=37.8 m^3/d, Recycle flow rate =5573 m^3/d, Biomass concentration in aeration tank, X=3000 mg/l, Over flow rate (O/F)=33 m/d. Find the : (i) solid loading rate (ii) Total height of the tank (iii) Weir loading rate	**4**
4A.	The 4-day BOD of a sample of sewage at 15 °C is 200 mg/l. Draw a plot of 5 day BOD as a function of temperature in the range of 10 °C to 30 °C in steps of 5 °C. Assume K value at 20 °C as 0.23 d^{-1}(base e).	**4**

4B	For a wastewater sample, 5-day BOD at 20 °C is 200 mg/l and is 67 % of the ultimate BOD. What will be the 4-day BOD at 30 °C.	**3**
4C	Describe the operation of Upflow Anaerobic Sludge Blanket (UASB) reactor for treatment of wastewater.	**3**
5A	A UASB reactor has been employed to treat food processing wastewater at 20 °C. The feed flow rate is 2 m^3/d with mean soluble COD of 7000 mg/L. Calculate the maximum CH_4 generation rate at 85 % COD removal efficiency and 10 % of the COD is utilized for biomass synthesis. The mean CH_4 content of biogas is 80%. If the wastewater contains 2 g/l sulfate, theoretically how much CH_4 could be generated?	**3**
5B	Explain the following ground water recharge methods i. Surface spreading in basins ii. Direct injection into groundwater aquifers	**3**
5C	Estimate the time required for a 99.9 % kill for a chlorine dosage of 0.05 mg/l at a temperature of 20 °C and pH of 8.5, using Chick and Watson equation. The coefficients in the Chick and Watson equations are obtained from the batch reactor data obtained at 5 °C and are as follows. Die-off constant =10.48 Activation Energy E=26,800 J/mole Coefficient of dilution=1.28 R=8.3144 J/mole.K	**4**