MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. EXTERNAL EXAMINATIONS END SEM APRIL 2018 SUBJECT: DESIGN OF BIOLOGICAL TREATMENT PROCESSES [BIO 4002]

Date of Exam: 26/04/2018 Time of Exam: 2.00 PM – 5.00 PM Max. Marks: 50

Instructions to Candidates:

Answer ALL the questions & missing data may be suitable assumed

1A.	What are the merits and demerits of rapid sand filters over slow sand filters?	4
1B.	The average flow rate at a small municipal wastewater treatment plant is 25000 m ³ /d. The highest observed peak daily flow rate is 50000 m ³ /d. Design rectangular primary sedimentation tank with a channel width of 5.4 m. Use a minimum of two clarifiers. Calculate i) the required surface area and tank length, ii) Detention time and overflow rate at average flow as well as at peak flow and iii) determine scouring possibility in the tank. Use an overflow rate of 32 m ³ /m ² .d at average flow and a side water depth of 3m.	6
2A.	Explain basic operations involved in the activated sludge process with help of a flow diagram.	4
2B.	Determine the amount of liquid alum required to precipitate phosphorus in a wastewater that contains 7.5 mg P/L. Also determine the required alum storage capacity if a 30 day supply is to be stored at the treatment facility. Based on laboratory testing, 1.25 mole of Al will be required per mole of P. The flow rate is 12500 m ³ /d. The following data are for the liquid alum [Al ₂ (SO ₄) ₃ .18H ₂ O] supply. Alum strength is 50 % and the density of liquid alum solution is 1.25 kg/L. Molecular weight of alum is 666.5, Al is 26.98 and P is 30.97.	6
3A.	How sequence batch reactors are used in the secondary treatment of wastewater?	4
3B.	Define sloughing. How does it impact the treatment process? Discuss the design considerations of a trickling filter.	6
4A.	Compare and contrast between attached growth processes over activated sludge treatment method.	6
4B.	A single stage trickling filter of 12 m diameter contains conventional cross flow plastic packing at a depth of 5.6 m. Primary effluent characteristics are 4200 m ³ /d, BOD 125 g/m ³ and TKN 25 g/m ³ . If this effluent is applied to the filter then determine volumetric BOD and TKN loading rate.	4
5A.	What do you understand by the term disinfection of water? What should be the requirements of a good disinfectant?	4
5B.	Estimate the time required for a 99.5 % kill for a chlorine dosage of 0.04 mg/L at a temperature of 25°C and pH of 8.5, using the data and relationship developed for treatment $ln \frac{N_t}{N_0} = -10.27 C^{1.15}t$. The test data given here were obtained at a temperature of 7°C using a batch reactor. Activation energy E = 25,600 J/mole.	6