Reg. No.										

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

VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)
END SEMESTER EXAMINATIONS, NOV/DEC 2018

SUBJECT: PE – VI : INDUSTRIAL WASTEWATER ENGINEERING

[CHE 4006]
REVISED CREDIT SYSTEM

Date : 01/12//2018 **Time: 2 – 5 PM** **MAX. MARKS: 50**

Instructions to Candidates:

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

1A.	Design an aerated grit chamber for treatment of municipal wastewater. Average flow rate is 0.2 m^3/s. Peak factor is 2.50.Assume detention time as 3 min at peak flow rate, width as 1.2 m and depth as 3 m. Also assume air supply of 0.3 m^3/min.m of length and quantity of grit as 0.05 m^3/1000 m^3 at peak flow.	**(5 marks)**
1B.	Prepare preliminary designs for a rotary disc type installation to serve 1000 persons. Assume 80% BOD removal at an organic load of 20 g of BOD_5/m^3.day and 3m diameter discs spaced 5 cm apart on centres. At 54 g of BOD/person.day and 200 lpcd, Flowrate Q is 200 m^3/day**.**	**(5 marks)**
2A.	Design a stabilization pond for the following data: Population = 5000 BOD_5 = 54 g/capita/day Wastewater production= 200 lpcd Minimum and maximum solar radiation = 110 Langley and 225 Langley Sky Clearance Factor = 85% Conversion efficiency = 6% Energy required for algae = 6 kcal/gm	**(6 marks)**
2B.	Show with a flow diagram the (i)Extended aeration process (ii) combined process of secondary treatment with contact filtration, carbon adsorption and reverse osmosis.	**(4 marks)**

3A.	Explain any two major problems encountered in ASP systems?	**(2 marks)**
3B.	Just below the point where a continuous discharge of pollution mixes with a river, the BOD is 10.9 mg/l and DO is 7.6 mg/l. The river and waste mixture has a temperature of 20°C, a deoxygenation constant of 0.20 day^{-1}, an average flow speed of 0.30 m/s and an average depth of 3.0 m. (i) Find the time and distance downstream at which the oxygen deficit is maximum (ii)Find the minimum value of DO.	**(4 marks)**
3C.	Design a high rate trickling filter with a flow rate of 150 m^3/hr. Influent BOD of raw wastewater is 180 mg/l. Effluent BOD is 30 mg/l. k = 0.1 day^{-1} at 20°C. The removable BOD is equal to 90% of the ultimate first stage BOD. Assume a depth of 2.7 m. Using Rankine's equation find the recirculation ratio and design the filter by NRC equation.	**(4 marks)**
4A.	Derive an expression for mean cell residence time, Sludge production rate and mass balance with biomass and with substrate using suitable mass balance equations for the sludge wastage from recirculation line.	**(8 marks)**
4B.	What is flow equalization process? Which type of flow equalization is more efficient?	**(2 marks)**
5A.	Describe the following terms along-with their significance (i) F/M ratio (ii) MLSS (iii) MLVSS (iv) Hydraulic retention time (v) Solid retention time (vi) Volumetric Loading rate (vii) Hydraulic Loading rate (viii)Recirculation Ratio (ix) Sludge age or mean residence time (x) Sludge Volume Index	**(5 marks)**
5B.	Write short notes on the following with diagram: (i)UASB reactor (ii)Fluidized Bed reactor	**(5 marks)**