Reg.No.										

MANIPAL UNIVERSITY

Seventh Semester B.Tech. (Chemical Engineering)

ELECTIVE (II): INDUSTRIAL WASTEWATER ENGINEERING (CHE 427)

MAKEUP EXAMINATION – JAN 2016

Time : 3 hrs **Max Marks: 100**

- **Answer any FIVE full questions and all questions carry equal marks.**
- **Missing data, if any, may be assumed suitably.**

1A.	A municipal wastewater having a BOD of 250 g/m^3 is to be treated by a two stage trickling filter.The desired effluent quality is 25 g/m^3 of BOD. If both of the filter depth are to be 1.83 m and the recirculation ratio is 2:1.Find the required trickling filter diameter. Data are given below: Flow rate = 7570 m^3/day, Wastewater temperature = 20°C and $E_1 = E_2$	**(12 marks)**
1B.	What are the important operating parameters of aerobic and anaerobic process and explain them?	**(8 marks)**
2A.	Distinguish between (a) Suspended- and attached- growth processes (b) Aerobic and anaerobic processes (c) Nitrification and denitrification (d) Extended aeration and Conventional ASP process	**(8 marks)**
2B.	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: depth ratio as 1.2:1 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.	**(12 marks)**
3A.	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 aeration tank.	**(12 marks)**
3B.	A mechanically aerated lagoon provides 5 days detention time to a wastewater flow of 20,000 m^3/day. Assume length: width as 4 :1. If its depth is to be restricted to 6m,estimate the lagoon dimensions so that the dispersion number D/uL will be 0.5 or less.	**(8 marks)**
4A.	Draw a bacterial growth curve and explain the significance of various phases. Show that $$Y_{obs} = \frac{Y_T}{\left(1 + \frac{k_d}{\mu}\right)}$$	**(10 marks)**
4B.	A wastewater treatment plant discharges 1.0 m^3/s of effluent having an ultimate BOD of 40.0 mg/l into a stream flowing at 10.0 m^3/s. Just upstream from the discharge point, the stream has an ultimate BOD of 3.0 mg/l. The deoxygenation constant k_d is estimated as 0.22 day^{-1}. (i) Assuming complete and instantaneous mixing, find the ultimate BOD of the mixture of waste and river just downstream from the outfall. (ii) Assuming a constant cross-sectional area for the stream equal to 55 m^2, what ultimate BOD would you expect to find at a point 10,000m downstream.	**(10 marks)**

5A.	Laboratory studies on a wastewater having a total BODu of 150 mg/l have shown that after 45 min of contact with an activated sludge culture initially containing 2000 mg/l MLVSS, the filtrate BOD_u is reduced to 15 mg/l. Determine the aeration volume for the contact and stabilization tanks using the following design criteria. X_c = 200 mg/l as MLVSS θ_c = 8 days , f= 0.8, SVI = 110 MLVSS = 0.8 × MLSS S_e = 15 mg/l of BOD_u, Q = 2 MGD Y_T = 0.5, k_d = 0.1 day^{-1}	**(12 marks)**
5B.	Explain the different modifications of ASP with a neat flow diagram	**(8 marks)**
6A.	(i)Write a note on Scour velocity, Approach velocity and Flow velocity. (ii)Explain Streeter-Phelps Oxygen Sag curve equation	**(12 marks)**
6B.	Explain different methods of sludge digestion in detail.	**(8 marks)**