國立成功大學

114學年度碩士班招生考試試題

編　號：106

系　所：環境工程學系

科　目：衛生工程

日　期：0210

節　次：第 1 節

注　意：1.可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

1. What are the major hydraulic differences between the flow in the pipeline of a water supply distribution system and that of a sewer system? Also explain the rationale behind these differences. (10%)

2. Based on the concentration of particles and the ability of the particles to interact, explain the differences between the settling that occurs in grit chamber in sewerage treatment plant and that in sedimentation tank in conventional drinking water treatment plant. (10%)

3. A flocculation tank 10 m long, 3 m wide and 3 m deep has a design flow of 0.05 m^3/s. Flocculation is achieved by three paddles each with two blades 2.5 m by 0.3 m, the center line of the blades being 1 m from the shaft which is at mid depth of the tank. The paddles rotate at 6 rpm and the ratio of the rotational velocity of the water to the velocity of the paddle is 0.3. Assume the coefficient of drag is 1.8. For water at 20 °C, mass density is 998.2 kg/m^3, dynamic viscosity 1.002 X 10^{-3} kg/m.s. Calculate the mean velocity gradient and GT value. (20%)
   (Hint: $P = C_D A \rho v^3/2$)

4. (1) Explain why the filter media in the rapid sand filter are stratified, but those in the slow sand filter are not. (5%)
   (2) Explain why slow sand filter usually have higher dissolved organic removal than that of rapid sand filter. (5%)

5. Assume a water containing 1 mg/L ammonia-nitrogen is chlorinated. Try to draw a diagram showing the breakpoint chlorination curve, and specify the major type of chlorine residuals (i.e., free or combined) at various regions of the curve, also show the chlorine demand at the breakpoint on the diagram. (15%)

6. What is infiltration in sanitary sewer system? What factors affect the rate of infiltration? Explain the methods used to estimate the rate of infiltration. (15%)

7. A completely mixed activated sludge plant is to treat 16,000 m^3/d of domestic wastewater. The wastewater after primary treatment has a BOD_5 of 160 mg/L that must be reduced to 10 mg/L prior to discharge. The biological reactor is to operate at a concentration of 3,600 mg/L MLSS. The secondary clarifier is designed to thicken the sludge to 12,000 mg/L, and the solids in the effluent are negligible compared to the influent and underflow. Assume the cell yield coefficient Y = 0.5 kg biomass/kg BOD utilized, endogenous decay coefficient = 0.04 d^{-1}. For a mean cell residence time of 8 d, determine
   (a) The volume of the aeration tank. (5%)
   (b) The BOD volumetric loading rate and F/M ratio of the process. (5%)
   (c) The mass of the solids and the wet volume of sludge wasted each day. (5%)
   (d) The recycle ratio. (5%)
   (Hint: $\frac{1}{\theta_c} = \frac{Y(S_o - S)}{\theta X} - k_d$)