編號： 148

國立成功大學 105 學年度碩士班招生考試試題

系　　所：環境工程學系

考試科目：衛生工程

考試日期：0227，節次：1

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (1) Explain what are "service reservoirs" and their function in public water distribution system. (10%)
   (2) Explain how to decide the required capacity of a service reservoir. (10%)

2. (1) Explain why the filter medium in the rapid sand filter is stratified, but that in the slow sand filter is not. (10%)
   (2) Explain why slow sand filter usually have higher dissolved organic removal than that of rapid sand filter. (10%)

3. A pump is to be installed in a straight horizontal pipe. The site is at an elevation of 900 m, the water temperature is 20℃ and the flow rate will be 8.4 m^3/min. The required NPSH is 5.0 m. Assume the local atmosphere pressure is 101.3 kPa, vapor pressure of water 2.34 kPa, and specific weight of water 9.792 kN/m^3. Calculate how far the pump can be located from the suction reservoir (el. 903 m) so that the available NPSH is 1 m larger than the required NPSH. The pipe diameter is 30 cm. Assume the friction factor of the Darcy-Weisbach equation is 0.0145. (20%)
   (Hint: Darcy-Weisbach equation $h_f = f(L/D)(v^2/2g)$; $NPSH_{available} = h_s + P_{atm}/\gamma - P_{vap}/\gamma - h_f$)

4. Sketch the flow diagram of a conventional waste sludge treatment process in sewage treatment plant, also give explanation for the function of each unit. (20%)

5. A completely mixed activated sludge plant is to treat 20,000 m^3/d of domestic wastewater. The wastewater after primary treatment has a BOD_5 of 160 mg/L that must be reduced to 5 mg/L prior to discharge. The biological reactor is to operate at a concentration of 3,000 mg/L MLSS, and the secondary clarifier is designed to thicken the sludge to 12,000 mg/L. 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
   (1)The volume of the aeration tank. (5%)
   (2)The BOD volumetric loading rate and F/M ratio of the process. (5%)
   (3)The mass of the solids and the wet volume of sludge wasted each day. (8%)
   (4)The sludge recycle ratio. (2%)

$$\frac{1}{\theta_c} = \frac{Y(S_0 - S)}{\theta X} - k_d$$