# 國立臺灣大學 106 學年度碩士班招生考試試題



1. What is Carlson trophic state index and how to use to determine the water quality in a reservoir? (10 points)

2. Water pollution can be categorized into two major origins: point sources and non-point sources. Answer the following questions.
   (a) Describe the important characteristics of point sources and non-point sources. (10 points)
   (b) Domestic wastewater is commonly collected using a combined sewer system. Describe the important characteristics of this system. (10 points)

3. Following $BOD_5$ test was done at 20°C for the wastewater collected from a milk processing plant. BOD bottles used were 300 mL. Before the test, the wastewater was already diluted 1/10 by pure water and the initial DO was 9.1 mg/L.

| Bottle number | Wastewater portion (mL) | Incubation time (day) | Final DO (mg/L) |
|---|---|---|---|
| 1 | 5 | 5 | 5.9 |
| 2 | 5 | 5 | 6.0 |
| 3 | 10 | 5 | 3.0 |
| 4 | 10 | 5 | 2.8 |
| 5 | 15 | 5 | 0 |
| 6 | 15 | 5 | 0 |

   (a) What is the $BOD_5$ concentration of the original wastewater? (10 points)
   (b) The average domestic wastewater flow and $BOD_5$ load are 200 L/day/person and 30 g/day/person, respectively. If the wastewater produced by the plant is 10 $m^3$/hr, calculate the hydraulic population equivalent (hydraulic PE) and $BOD_5$ population equivalent ($BOD_5$ PE) of the milk processing plant. (10 points)

4. Type I Sedimentation is characterized by discrete particle settling. Prove the terminal settling velocity ($v_s$) for a spherical particle (diameter = $d_p$) is equal to:

$$v_s = \left[\frac{4g(\rho_p - \rho_w)d_p}{3C_D\rho_w}\right]^{1/2}$$

   *where* $\rho_p$ = density of particle; $\rho_w$ = density of water; g = acceleration due to gravity;
   $C_D$ = drag coefficient.
   Describe any assumption you use. (10 points)

5. Explain the following terms:
   (a) Disinfection byproducts (5 points)
   (b) Rapid granular filtration (5 points)
   (c) Electrical double layer compression (5 points)

6. Please draw a flow diagram for a domestic wastewater treatment plant aiming water reuse. Identify the function for each process. (15 points).

7. Anaerobic treatment is a biological process in the absence of $O_2$ for the stabilization of organic materials. Describe the steps of anaerobic digestion. Also explain the advantages of anaerobic process. (10 points).

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