國立臺灣大學 103 學年度碩士班招生考試試題

1. Explain the following terms:

   (a) Total maximum daily load (TMDL) (5 points)

   (b) Best management practices (BMPs) (5 points)

   (c) Water surface effects (5 points)

   (d) Pump cavitation (5 points)

2. Two monitoring wells located 500 m apart along the direction of groundwater flow were used to monitor the groundwater in a confined aquifer. The confined aquifer has a thickness of 20 m and a width of 100 m. The difference in water levels in the wells is 2 m. The hydraulic conductivity is 50 m/day and the porosity of the aquifer is 35%. Darcy's Law shown below can be used to describe the flow in the aquifer.

$$Q = KA\left(\frac{dh}{dL}\right)$$

   Q = flow rate (m^3/day)
   K = hydraulic conductivity (coefficient of permeability) (m/day)
   A = cross sectional area (m^2)
   (dh/dL) = hydraulic gradient

   (a) Estimate the groundwater flow rate (5 points)

   (b) If the upgradient well is contaminated, how long after would you expect the downgradient well to be contaminated? Assume (1) no dispersion, (2) the contaminant moves at the same speed as the groundwater, and (3) the downgradient well doesn't not pull the contaminant plume (10 points)

3. Describe how to select a centrifugal pump that can be used to provide the necessary pressure and flow rate of finished water in the distribution system. (15 points)

4. Coagulation is a process to increase the tendency of small particles forming larger aggregates in the conventional water treatment.
   Describe its working principle and destabilization mechanisms. (15 points)

5. Describe the oxygen sag curve and it's the relationship to BOD removal in a stream. (10 points)

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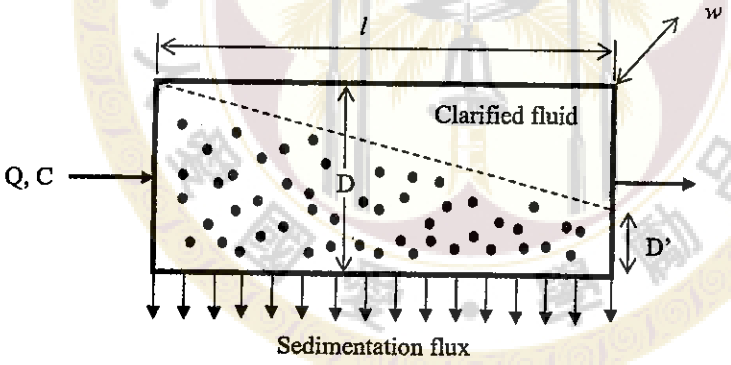
6. For storm water design, a residential area of 0.1 km^2 has 25 percent of roofs, 25 percent of paved driveways and walks, 20 percents of Portland cement streets, and the reaming area is grassy lawns with little slope.

(a) Estimate the runoff coefficient for this area. (5 points)

Runoff coefficients for various surfaces	
Type of surface	*C*
Roofs	0.70
Paved driveway and walks	0.80
Portland cement streets	0.85
Grassy lawns with 2% slope	0.10

(b) If the rainfall intensity is equal to 150 mm/hr, use the rational method to determine the peak runoff rate (m^3/sec). (5 points)

7. Consider the fractional removal of steady, continuous quiescent sedimentation in a rectangular chamber ($l \times w \times$ D), as the following picture.



Based on the conservation of mass, show that the fraction removal in this system can be expressed as:

$$R=1-D'/D$$

where Q is the flow rate, C is the constant particle concentration, and D' is the depth of uncleared fluid leaving the system. (15 points)

[Hint]: [Accumulation] = [Input] – [Output] + [Generation/Consumption]

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