

國立成功大學

111學年度碩士班招生考試試題

編 號： 140

系 所： 環境工程學系

科 目： 衛生工程

日 期： 0219

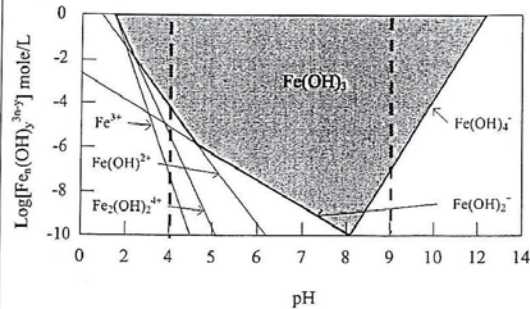
節 次： 第 1 節

備 註： 可使用計算機

※ 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. Answer the following questions or explain the terms. (30%)

- (1) Describe the challenge(s) in the water resource management in Taiwan.
- (2) Please describe how to evaluate if building a reservoir is needed to store the water resource for a river.
- (3) Compare the systems of water transmission by gravity and pumping.
- (4) Given the logC-pH plot as follows, what is the optimal pH in coagulation using  $\text{FeCl}_3$  as the coagulant? Explain why.



(5) DLVO theory describes the inter-particle forces of colloidal particles. Please draw the interaction energy of respective forces (label each force) and the total energy as a function of particle distance when two particles approach each other for FAVORABLE aggregation.

(6) Explain why the use of multiple media is beneficial in granular filtration.

2. Derive the terminal settling velocity (i.e., the Stokes equation) for particle sedimentation. (10%)
3. Consider a confined aquifer with a coefficient of transmissivity  $T = 680 \text{ ft}^3/\text{day}/\text{ft}$ . At  $t = 5 \text{ min}$ , the drawdown  $s = 5.6 \text{ ft}$ , at  $50 \text{ min}$ ,  $s = 23.1 \text{ ft}$ , and at  $100 \text{ min}$ ,  $s = 28.2 \text{ ft}$ . The observation well is  $75 \text{ ft}$  away from the pumping well. Find the discharge,  $Q$ , of the well. (10%)
4. Given a flow rate of  $7,200 \text{ m}^3/\text{d}$  and detention time of  $4 \text{ h}$ , design a rectangular coagulation sedimentation tank (i.e., determine the depth, length and width). Please use appropriate rules for your design (i.e., surface loading, length/width ratio, depth, and horizontal velocity). (15%)
5. The data for system head and the pump characteristic curves are shown as follows.
  - (1) Determine the flow and head at which the pump operates. (5%)
  - (2) Determine the motor horsepower by assuming appropriate pump and motor efficiencies. (5%)

Total head (m)	Q (m <sup>3</sup> /min)	Total dynamic head (m)	Q (m <sup>3</sup> /min)
95	400	70	500
90	800	80	850
85	1050	85	975
80	1200	90	1075
70	1450	100	1300

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6. Calculate the recommended minimum backwash rate for a single-medium, coarse-sand filter at 20°C ( $\rho_w = 998.2 \text{ kg/m}^3$ ;  $\mu = 1.0 \times 10^{-3} \text{ kg/m}\cdot\text{s}$ ). The grain diameter of a sphere of equal volume is 1.2 mm, density of sand is 2650 kg/m<sup>3</sup>, filter depth is 1.0 m and porosity is 0.4. (15%)
7. Given a reaction rate constant  $k'$  of 0.115 L/min-mg at pH = 7.0 and 20°C for disinfection using chlorination, what is the C-t value required for a 3-log removal of Giardia? If the chlorine dose is maintained at 1 mg/L and flow rate Q is 10,000 CMD, what is the size (as m<sup>3</sup>) of chlorine contact tank? (10%)