

本試題是否可以使用計算機：☒可使用，☐不可使用（請命題老師勾選）

考試日期：0301，節次：1

1. What is the *specific speed* (or called *type number*) of centrifugal pumps? Also explain how specific speed is related to pump selection for various applications, which means various combinations of flow rate and total dynamic head? (10%)
2. Compare the *conventional dual-media filter* verse *single-medium deep-bed filter using coarse sand* for rapid filters for drinking water treatment, based on media depth, materials and grain sizes, stratification of media, and methods of backwashing. (10%)
3. What are *disinfection by-products* (DBPs)? Name the major DBPs of chlorine and ozone, and explain the mechanisms of their formation. (10%)
4. (a) Explain the difference in coagulation mechanisms when alum is used to treat high turbidity (e.g. 100 NTU) surface water and low turbidity groundwater (e.g. 5 NTU), respectively.
(b) What is alkalinity? Also explain the role of alkalinity in alum coagulation. (10%)
5. Give the possible applications of activated carbon in drinking water treatment. Also compare the two major types of activated carbon used, especially how they are used in drinking water treatment processes. (10%)
6. Sketch a flow diagram of an activated sludge process, and give a description of its operation. What is sludge bulking? How is SVI (sludge volume index) value related to bulking? How may bulking be controlled? (20%)
7. What are *septic tank* and *leaching field* in an on-site subsurface wastewater disposal system? Also explain their functions. (10%)
8. (a) A wastewater treatment plant consists of primary treatment followed by an activated sludge secondary system. Sludge from the primary clarifier and wasted activated sludge are mixed and thickened in a gravity thickener. With thickening, the solids content increases from 1.0 percent to 4.0 percent. In the mixed sludge, organic content of the total solids is 60 percent, while the specific gravity of the volatile and fixed solids is 1.0 and 2.5, respectively. Assuming the mixed sludge contains 1200 kg of dry solids per day, calculate the daily volume of the mixed sludge before and after thickening, and the percentage of volume reduction.
(b) Assuming heated (35°C) standard-rate digestion is used to stabilize the thickened sludge from (a). The solids content of the digested sludge is 6 percent, while 60 percent of the volatile solids are converted to gaseous or liquid end products during digestion. The digestion period is 30 d and the sludge must be stored for 45 d between final disposal events. Determine the required digester volume and the volatile solids loading rate ($\text{kg}/\text{m}^3 \cdot \text{d}$). (20%)