

National Examination May 2011

98-Civ-B5, Water Supply and Wastewater Treatment

3 hours duration

Notes:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is an OPEN BOOK EXAM.
3. Any non-communicating calculator is permitted.
4. Answer all questions from PART A and any TWO questions from B1, B2, and B3.
5. Values of all questions are indicated.
6. Clarity and organization of the answer are important.

PART A (total 50 marks)

A1 (20 marks)

- (i) Explain briefly: "There is roughly an order of increase in coagulation ability with each unit increase in charge of an ion". **(10 marks)**
- (ii) A sludge contains 200 mg/L of Fe as $\text{Fe}(\text{OH})_3$. how much sulphuric acid will be needed to solubilise the iron? **(10 marks)**

A2 (30 marks)

- (i) Algae in stabilization ponds can act to remove hardness from water when they are metabolically active. Explain how this could happen. **(8 marks)**
- (ii) Compare and contrast a sand filter with a trickling filter. **(12 marks)**.

A3 An activated sludge process has an influent waste water flow of 8000 m^3 per day. The influent COD is 240 mg/L and the effluent COD is 30 mg/L. The sludge retention time is 4 days and the hydraulic retention time is 4 h. The MLVSS is 1500 mg/L and mg COD/ mg VSS is 1.58. Calculate the rate of oxygen consumption. **(10 marks)**

Part B (50 marks). Answer two of the following three.

B1 (25 marks)

- (i) What effect do inorganic reducing agents have on COD and COD determination. **(10 marks)**
- (ii) A sample has 28 mg/L of ammonia. If only 4% of the ammonia present in the sample is oxidized what is the COD of the ammonia. **(15 marks)**

B2 (25 marks) Calculate the surface overflow rate and horizontal flow velocity for a clarifier given the following: Rectangular clarifier, ratio of length to width is 3:1; Influent flow rate $1000 \text{ m}^3/\text{day}$; depth of clarifier 5.0 m and detention time 2.5 h.

B3 (25 marks) A waste has a COD of 5000 mg/L. The wastewater flow is $1250 \text{ m}^3/\text{d}$ and 60 percent of the waste is anaerobically digested. Calculate the methane generation rate. Also calculate the maximum yield of methane in m^3 of methane per Kg of COD consumed.