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 Fe(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 m³ 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 m³/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 m³/d and 60 percent of the waste is anaerobically digested. Calculate the methane generation rate. Also calculate the maximum yield of methane in m³ of methane per Kg of COD consumed.