NATIONAL EXAMINATION, May 2016

98-CIV-B5-Water Supply and Wastewater Engineering

3 hours duration

Notes:

1. Question 1 is compulsory, attempt any three questions from the remaining four questions.
2. If doubts exist as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
3. This is a closed book exam. However, one aid sheet is allowed written on both sides.
4. An approved calculator is permitted.
5. Marks of all questions are indicated at the end of each question.
6. Clarity and organization of answers are important.

Q1 (25 marks)

Describe and explain the significance of the following water and wastewater characteristics:

i. Turbidity **(5 marks)**
ii. Coliform forming units **(5 marks)**
iii. Hardness **(5 marks)**
iv. Biochemical oxygen demand **(5 marks)**
v. Total ammonia nitrogen and free ammonia **(5 marks)**

Q2 (25 marks)

a. Chlorine demand of a water sample is a function of the concentration of inorganic and organic compounds and ammonia in water. Explain with the help of the chlorination curve. **(15 marks)**
b. Efficiency of chlorination is a function of the pH. Explain graphically **(10 marks)**

Q3 (25 marks)

a. Explain the importance of BOD_5, ammonia nitrogen and phosphorus limits on the treated effluent from wastewater treatment plants. **(15 marks)**
b. Give a brief description of your understanding of sludge stabilization, and sludge thickening and dewatering in wastewater treatment. **(10 marks)**

Q4 (25 marks)

Describe the following in water treatment:

a. UV radiation based disinfection. **(8 marks)**
b. With the help of a process schematic, describe the operation of a rapid sand filter. **(9 marks)**
c. Discrete, flocculent and hindered settling. **(8 marks)**

Q5 (25 marks)

a. With the help of a process schematic, explain the working principle and operation of the activated sludge process. **(10 marks)**
b. Determine the SRT of an activated sludge system with raw sewage flow of 4000 m^3/d, aeration tank volume of 1,000 m^3, MLSS concentration of 3,000 mg/L, waste sludge production of 80 m^3/d, and the return activated sludge solids concentration of 8,000 mg/L. If the secondary clarifier area is 250 m^2, find out the solids loading rate and surface overflow rate. **(15 marks)**