

NATIONAL EXAMINATION, DECEMBER 2016

98-CIV-B5-Water Supply and Wastewater Treatment

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. Alkalinity (5 marks)
- iv. Chemical oxygen demand (5 marks)
- v. Total nitrogen and TKN (5 marks)

Q2 (25 marks)

- a. Explain the concepts of Chlorine demand, combined residual chlorine, breakpoint chlorination, and free residual chlorine with the help of the chlorination curve. (15 marks)
- b. Describe the key causes and significance of taste & odour, and hardness in water sources (10 marks)

Q3 (25 marks)

- a. Define and explain the significance of solids retention time and surface overflow rate in the activated sludge process for wastewater treatment. (15 marks)
- b. Give a brief description of the mechanism of anaerobic sludge stabilization in wastewater treatment. (10 marks)

Q4 (25 marks)

Describe the following in water treatment:

- a. Schmutzdecke and backwash in rapid sand filters. (8 marks)
- b. The key design and operating principles of UV disinfection systems. (9 marks)
- c. Mechanisms of contaminant removal in the filtration process. (8 marks)

Q5 (25 marks)

- a. With the help of a process schematic, explain the working principle and operation of a trickling filter. (10 marks)
- b. Determine the SRT of an activated sludge system with average raw sewage flow of 4000 m³/d, aeration tank volume of 1,000 m³, MLSS concentration of 3,000 mg/L, waste sludge production of 80 m³/d, and the return activated sludge solids concentration of 8,000 mg/L. Also calculate the surface area of the secondary clarifier so that the surface overflow rate does not exceed 40 m³/m²-d under peak flow condition. Make suitable assumptions. (15 marks)