

**NATIONAL EXAMINATION, DECEMBER 2012**

**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 the sources, significance and units of measurement of the following parameters of water quality.

- i. Hardness (5 marks)
- ii. Taste and odour (5 marks)
- iii. Fluorides and Nitrates (5 marks)
- iv. Pathogens (5 marks)
- v. Iron and manganese (5 marks)

**Q2 (25 marks)**

What do you understand by optimum coagulant dose in water treatment? Describe the procedure of jar test in determining the optimum coagulant dose for the coagulation process. (25 marks)

**Q3 (25 marks)**

A city draws its water from a large reservoir which has a turbidity of 30 to 50 NTUs and hardness of 250 mg/L. Also, the raw water has seasonal taste and odour which is categorized as "fishy" or "musty".

Draw a schematic diagram of a treatment plant that will render this water potable and safe to drink.

Identify each unit and briefly state its purpose. Show points of chemical addition and identify the chemicals. (25 marks)

**Q4 (25 marks)**

Describe the significance of the following in chlorination of water

- i. pH (7 marks)
- ii. Contact time (6 marks)
- iii. Concentration of cations,  $H_2S$  and organics in raw water (6 marks)
- iv. Free and combined residual chlorine (6 marks)

**Q5 (25 marks)**

- i. With the help of process schematic, describe the working of conventional activated sludge process. (15 marks)
- ii. For a BOD test, thirty (30) mL of a wastewater sample with DO of zero was mixed with 270 mL dilution water of DO 10 mg/L, and put into an incubator at 30°C. The sample was taken out of the incubator after seven days and its DO was found to be 4 mg/L. Assuming a reaction rate constant "K" value of 0.2 at 20°C and  $K_T = K_{20} (1.05)^{T-20}$ , Determine the five day BOD at 20°C. (10 marks)