NATIONAL EXAMINATION, DECEMBER 2016

04-ENV-A4-Water 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)

Define and explain the following terms in water and wastewater engineering

i. Grit removal in wastewater treatment **(6 marks)**
ii. Carbonaceous BOD_5 and azide modification of BOD_5 test **(7 marks)**
iii. Oxygen sag curve in stream pollution **(6 marks)**
iv. Indicator organism in water quality analysis **(6 marks)**

Q2 (25 marks)

a. Name and describe the various species of Nitrogen in municipal wastewater treatment. Explain the two key mechanisms of Nitrogen removal in wastewater treatment. **(15 marks)**
b. Explain the importance of organic compounds and ammonia in chlorination based disinfection of water. Give two advantages and two disadvantages of UV disinfection over chlorination for disinfection. **(10 marks)**

Q3 (25 marks)

a. What do you understand by raw water intake structures? Show the schematic of a typical intake system from a lake and list the key requirements for site selection of a water intake. **(10 marks)**
b. 3 ml of a raw sewage sample diluted to 300 mL in a BOD bottle had an initial DO of 8.0 mg/L. After 4 days of incubation at 15°C, the DO in the sample was measured at 4.5 mg/L. Assuming 5% of the oxygen demand over this 4-day period being contributed by the seed in the sample, determine the standard BOD_5 and ultimate BOD of the sample. **(15 marks)**

Q4 (25 marks)

a. List the key requirements of an adequate water distribution system. Discuss the advantages and disadvantages of grid iron and dead end system **(10 marks)**
b. Describe anaerobic digestion of municipal wastewater sludge with special reference to the digestion mechanism and the key operating parameters of an anaerobic digester. **(15 marks)**

Q5 (25 marks)

Give a brief description of the following in water and wastewater treatment:

a. Design and operating principal of aerated grit removal tanks **(6 marks)**
b. Ion exchange process in water treatment **(7 marks)**
c. Fluoridation and defluoridation **(6 marks)**
d. Sludge volume index and sludge bulking **(6 marks)**