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18CV55

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Municipal Wastewater Engineering

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the different types of sewerage systems with their advantages, disadvantages and suitability. **(10 Marks)**
   b. Explain Dry Weather Flow (DWF) and explain the factors on which DWF depends. **(10 Marks)**

OR

2 a. Define sewer appurtenances. Explain with neat sketch, construction and working of manhole. **(10 Marks)**
   b. Explain any five different shapes of sewers with neat sketches. **(10 Marks)**

Module-2

3 a. Design a sewer for a population of 50,000 with per capita water supply of 150 lit/day. The slope available is 1 in 500 and 80% of the water supplied emerges as sewage. The sewer is to be designed to carry 4 times the DWF when running full. Assume $N = 0.012$ and compute the velocity of flow when running full. **(10 Marks)**
   b. Explain self cleaning velocity and non-scouring velocity. What are different types of sampling? Explain. **(10 Marks)**

OR

4 a. Draw a neat flow diagram employed for a municipal wastewater treatment plant. Indicate the importance of each unit indicated in the flow diagram. **(10 Marks)**
   b. The 5 day 30°C BOD of sewage sample is 110 mg/l. Calculate its 5 days 20°C BOD. Assume the deoxygenation constant at 20°C, K_{20} as 0.1. **(06 Marks)**
   c. Explain the term BOD and their importance in wastewater treatment. **(04 Marks)**

Module-3

5 a. Explain the working of a "Grit Chamber" and "Oil and Grease" removal tank with figures. **(10 Marks)**
   b. Write short notes on: (i) Screens   (ii) Settling tank **(10 Marks)**

OR

6 a. Discuss in detail the process of de-oxygenation and re-oxygenation with respect to self-purification of natural water with a neat sketch. **(10 Marks)**
   b. A city discharges 100 cumecs of sewage into a river which is fully saturated with oxygen and flowing at the rate of 1500 cumecs during its lean days with a velocity of 0.1 m/sec. The 5-days BOD of sewage at the given temperature is 280 mg/l. Find when and where the critical D.O. deficit will occur in the downstream portion of the river, and what is its amount. Assume coefficient of purification of the steam (f) as 4.0 and coefficient of de-oxygenation (K_D) as 0.1. (Take saturated D.O. = 9.2 mg/l). **(10 Marks)**

Module-4

7   a.   Explain the five modifications of activated sludge processes.   **(10 Marks)**

    b.   The sewage is flowing at 4.5 million litres per day from a primary clarifier to a standard rate trickling filter. The 5-day BOD of the influent is 160 mg/l. The value of the adopted organic loading is to 160 gm/m^3/day, and surface loading 2000 l/m^2/day. Determine the volume of the filter and its depth. Also calculate the efficiency of this filter unit.   **(10 Marks)**

OR

8   a.   Explain briefly with neat sketches, the working of :
     (i)   Sludge digester's
     (ii)   Sludge drying beds   **(10 Marks)**

    b.   Calculate the dimensions of an oxidation pond for treating sewage from a residential colony with a population of 5000 persons. Assume the rate of sewage flow 120 $l$pcd and 5 day BOD of sewage as 300 mg/l. Take organic loading as 300 kg/ha/day and length of the tank as twice of its width and depth of pond as 1.2 m. Apply check for detention time.   **(10 Marks)**

Module-5

9   a.   Write about the need for advanced wastewater treatment? Explain the biological phosphorus removal process.   **(10 Marks)**

    b.   What is the necessity for the removal of nitrogen? Discuss the nitrification and denitrification process for removal of nitrogen.   **(10 Marks)**

OR

10 a.   Explain the septic tank with neat sketch. Also write the design considerations required for septic tank.   **(10 Marks)**

    b.   Write brief note on with sketch:
     (i)   Two-pit latrines
     (ii)   Soak pits   **(10 Marks)**

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