Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: IDD (B.Tech and M.Tech)**
Sub_Code: RCI5C002

5th Semester Regular/Back Examination: 2024-25
SUBJECT: Water and Waste Water Engineering
BRANCH(S): C&EE, CIVIL, ENV, CE
Time: 3 Hours
Max Marks: 100
Q.Code: R138

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Discuss different types of pumps used in water supply.
b) Describe the major waterborne diseases and their modes of transmission through contaminated water.
c) Discuss the working principles of Coagulation.
d) Write down different methods of disinfection.
e) Draw a schematic diagram of a conventional water treatment plant mentioning each unit.
f) Discuss the working of RBC with a neat sketch.
g) What are the functions of primary clarifier in waste water treatment plant?
h) Write down different hydraulic formulae for determining flow velocities for sewer and drain.
i) The 5 day at 20°C BOD test result of a 100 times diluted waste water sample is as follows: Initial dissolved oxygen: 7.1 mg/L, Final dissolved oxygen: 2.3 mg/L. Find BOD5?
j) Discuss the key parameters commonly regulated in effluent standards and their permissible limits.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) A pump is to deliver water from an underground tank against a static head of 40 m. The suction pipe is 50 m long and is of 25 cm diameter with Darcy-Weisbach friction factor f = 0.02. The delivery pipe is of 20 cm diameter, 1600 m long and f = 0.022. The pump characteristics may be expressed as $H_p = 100 - 6000\ Q^2$. Where H_p = pump head in meters and Q = discharge in m^3/sec. Calculate the head and discharge of the pump.
b) Evaluate the advantages and disadvantages of using surface water and groundwater as sources of drinking water.
c) What are the different methods of water softening? Describe Lime Soda method of water softening in detail.
d) Explain different waste water characteristics.
e) Discuss the different stages in sludge digestion process and factors affecting the process.
f) What is an intake? List the factors that govern the selection of a site for intake structure?

g) The population of a town is 10,000 and the average per capita demand is 200 L/p/d. Water is passing through a sedimentation tank which is 6 m wide, 15 m length and having a water depth of 3 m:

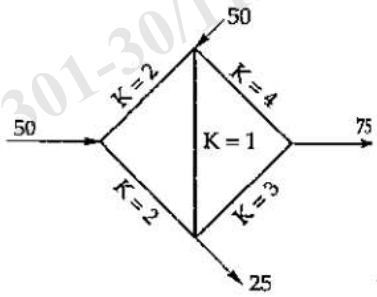
I. Find the detention time for tank.
II. What is average flow velocity through tank?
III. Compute the overflow rate.

h) Discuss the working principles of any of **three** water treatment processes: I. Sedimentation, II. Ion exchange, III. adsorption IV. Aeration

i) Design a sewer for a maximum discharge of 650 L/s running half full as well as running full. Consider Manning's rugosity coefficient n = 0.012, and gradient of sewer S = 0.0001.

j) Explain the working principle of a standard activated sludge process with the help of a neat sketch. Mention the advantages and disadvantage of this process.

k) Analyse the pipe network shown in the figure and tabulate the flow values in each pipe. Assume suitable values.



l) Distinguish between primary treatment and secondary treatment. Draw the flow diagram for treatment of sewage using activated sludge process.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Discuss any **eight** water quality parameters w.r.t. source, detection/analysis, impact and their significance. **(16)**

Q4 **a)** Differentiate between slow sand filter and rapid sand filter with reference to the following parameters (a) rate of filtration (b) efficiency (c) size (d) method of cleaning (e) period of cleaning (f) effective size [d_{10}] of sand. **(9)**

b) Differentiate between slow sand filter and rapid sand filter with reference to working principle/operation with neat sketches. **(7)**

Q5 Discuss the relative merits of the separate and combined systems of sewage and give the conditions favorable for the adoption of each one of them. Write different methods of estimation of storm water runoff. **(16)**

Q6 Discuss the working principles of trickling filter with a neat sketch and also discuss merits and demerits. Design a trickling filter to treat 5.0 MLD of sewage of BOD of 310 mg/l. The final effluent should be 40 mg/l and organic loading rate is 350 g/m^3/d. **(16)**