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

Total Number of Pages: 02

Course: B.Tech
Sub_Code: RCI5C002

5th Semester Back Examination: 2025-26
SUBJECT: Water and Waste Water Engineering
BRANCH(S): CIVIL, ENV
Time: 3 Hours
Max Marks: 100
Q.Code: U471

Answer Q1 (Part-I) 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) Describe the major waterborne diseases and their modes of transmission through contaminated water.

b) Explain the different types of water sources available for water supply. Discuss the factors to consider when selecting a suitable water source.

c) What are the desirable limits of turbidity, total dissolved solids, iron and total hardness (as per IS 10500)?

d) Differentiate between coagulation and flocculation.

e) Why aeration is done. Write down different methods of aeration.

f) Find the diameter of the sewer for a maximum discharge of 700 L/s running half full. Consider Manning's rugosity coefficient n = 0.013, and gradient of sewer S = 0.00015.

g) Explore the principles and applications of rotating biological contactors (RBCs) in wastewater treatment.

h) What is the purpose of providing primary sedimentation tank in wastewater treatment? What is the expected BOD and SS removal is primary sedimentation tank?

i) Define the term "sludge dewatering." Briefly explain two common methods used for dewatering sludge in wastewater treatment.

j) What is the objective of tertiary treatment in wastewater systems?

Part-II

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

a) Draw a labelled line diagram of a conventional water treatment plant and explain in detail the function of each unit.

b) Enumerate and discuss in brief any six physical, chemical, and bacterial characteristics of raw water supplies.

c) The population of a town is 20,000 and the average per capita demand is 100 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.

d) Write a short note on any of the two: (I) ion exchange (II) adsorption (III) natural purification of water sources

e) Discuss the different types of pumps used for water supply and the factors influencing pump selection.

f) The catchment area is of 300 hectares. The surface cover in the catchment can be classified as given below:

Type of cover	Coefficient of runoff	Percentage
Roofs	0.90	15
Pavements and yards	0.80	15
Lawns and gardens	0.15	25
Roads	0.40	20
Open ground	0.10	15
Single family dwelling	0.50	10

Calculate the runoff coefficient and quantity of storm water runoff, if intensity of rainfall is 30 mm/h for rain with duration equal to time of concentration. If population density in the area is 350 persons per hectare and rate of water supply is 200 LPCD, calculate design discharge for separate system, partially separate system, and combined system.

g) Discuss the different stages in sludge digestion process and factors affecting the process.

h) 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.

i) Draw a schematic flow diagram of a typical conventional sewage treatment plant and write down the functions of each treatment unit.

j) Write a short note on any of the two: (i) Waste water disposal standards, (ii) Grit chamber, (iii) equalization basin, and (iv) skimming tank

k) Sketch and label the bacterial growth curve for a pure culture. Explain each phase labelled on the curve.

l) With a neat diagram, explain the components of a water distribution system and their functions.

Part-III

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

Q3 **a)** What is an 'intake structure'? Discuss the factors governing location of Intake. **(8)**

b) Water is to be lifted from a tube well to overhead tank. Find the BHP of the pump from following data: Discharge from tube well – 60 lit/sec, R.L. of ground – 201.5 m, R.L. of water in tube well – 180 m, depression head during pumping – 4 m, R.L. of bottom of overhead tank – 220.5 m, depth of water in tank – 3.5 m, length of rising main – 100 m, f' = 0.01, efficiency – 70%, velocity of water in rising main – 2 m/sec. **(8)**

Q4 **a)** Differentiate between slow sand filter and rapid sand filter with reference to the following parameters any four (I) rate of filtration, (II) efficiency, (III) size, (IV) method of cleaning, (V) period of cleaning, and (VI) effective size [d_{10}] of sand. **(8)**

b) Discuss different methods of water softening. Compare lime-soda and zeolite processes. **(8)**

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

Q6 Discuss the working principles of activated sludge process along with merits and demerits. Design a complete mixed activated sludge process aeration tank for treatment of 35 MLD sewage having Influent BOD concentration of 250 mg/L. The effluent should have BOD of 20 mg/L or less. Consider the following: Volume of aeration tank = 10900 m^3, MLSS = 2500 mg/L, Effluent suspended solids = 30 mg/L, Waste sludge suspended solids = 9700 mg/L, Quantity of Waste sludge = 220 m^3/d. Find (I) Treatment efficiency based on BOD (II) HRT (III) F/M ratio (IV) volumetric loading (V) mean cell residence time. **(16)**