Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech. (Full Time) - END SEMESTER EXAMINATIONS, APRIL/MAY 2024

CIVIL ENGINEERING DEPARTMENT

IV Semester

CE5401 WATER SUPPLY ENGINEERING

(Regulation 2019)

Time: 3 hours | Answer ALL Questions | Max. Marks: 100

CO1	Understand the various components of water supply scheme
CO2	Design of intake structure and conveyance system for water transmission
CO3	Understand the process of conventional treatment of water and design of water treatment system.
CO4	Able to Understand and design the various advanced treatment system and knowledge about the recent advances in water treatment process
CO5	ability to design and evaluate water distribution system and water supply in buildings

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	State the bacteriological quality of drinking water as per IS10500: 2012.	2	1	1
2	List out any two factors affecting per capita water demand.	2	1	1
3	What is a water intake?	2	2	1
4	What is a pump and system curve plot?	2	2	2
5	Chlorine used in a WTP for treating 10 MLD of water is 34 kg/d. The residual chlorine observed after 30 minutes contact is 0.4 mg/L. Determine the chlorine demand.	2	3	1
6	State the objectives of aeration operation in water treatment.	2	3	4
7	How is fluoride removed from potable water?	2	4	2
8	Distinguish between ultrafiltration and nanofiltration.	2	4	1
9	What are the requirements of good water distribution system?	2	5	2
10	List out the components of house water supply service connection.	2	5	1

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Marks	CO	BL
11 (a)	Enumerate and explain the characteristics of surface water and ground water and state their environmental significance.	13	1	1
	(OR)			
11 (b)	The population of a town as per past census records are furnished below. Forecast the population in the year 2041 and 2051 using the following methods: (i) Arithmetical increase method (ii) Geometrical increase method (iii) Incremental increase method. (iv) Graphical method	13	1	3

Census year	1951	1961	1971	1981	1991	2001	2011	2021
Population	34642	40487	46816	55859	61458	68543	78131	106500

12(a) i)	Enumerate and explain the various pipes used in water conveyance system.	8	2	1
ii)	What factors are required to be considered in the selection of the type of a pipe materials?	5	2	1
	(OR)			
12 (b)	A centrifugal pump is installed in a water supply system with a population of 85000 at a per capita water supply rate of 135 Lpcd to raise water from one reservoir to another. The water surface elevation in the first reservoir is 140 m and that in the second reservoir is 195 m. The pipeline connecting the reservoir is 7.6 km and the flow velocity in the pipe line as 1.2 m/s. Design the size of the pumping main. Also calculate the power requirement of motor by assuming overall efficiency as 80%. What will be the annual energy consumption charges? Assume C_H value of pipe as 110 and energy charge per unit is Rs.6/-(Rupees Six only).	13	2	4
13 (a)	A new township is to have a population of 4,50,000 and 135 Lpcd of water supply.Design a rapid sand filter unit with details of under drainage and water washing including gutter arrangement. Limit the maximum spent backwash water as 4 %.	13	3	3
	(OR)			
13 (b)	Draw a neat sketch of a conventional surface water treatment plant and explain the various unit operations and processes involved in it.	13	3	1
14 (a)	Determine the volumes of cation and anion exchanger beds to demineralize 0.35ML/d water that has the following chemical quality. The ion exchange capacities of cation and anion exchange resins are 70,000 and 40,000 g $CaCO_3/m^3$ cycle, respectively. Also, calculate the required quantities of regeneration chemicals. The regeneration cycle is once per day.	13	4	3

Cations	Anions
Ca^{2+} = 30 mg/L	HCO_3^- = 50 mg/L
Mg^{2+} = 5 mg/L	SO_4^{2-} = 45 mg/L
Na^+ = 25 mg./L	Cl^- = 45 mg/L
K^+ = 10 mg/L	NO^-_3 = 10 mg/L

(OR)

14 (b)	Develop the design, and size the various components of a reverse osmosis system, to produce desalinated water having a TDS concentration of less than 500 mg/L. The plant capacity is 25 MLD. Use the following data: TDS of sea water — 35000 mg/L Solvent Recovery factor: R — 55 percent Salt-rejection factor, S — 99.6 percent Design pressure, P — 60 bar Feed water temperature, T — 27°C Volume of single module — 30 L Packing density — 820 m^2/m^3 Flux rate, f — 25 $L/m^2/h$	13	4	4
15 (a)	A town requires a water supply of 6 ML/d. Estimate the storage capacity of service reservoir required for the demand shown in the table for 16 hours continuous pumping from 4.00 am. Also express the capacity as percentage of daily demand.	13	4	3

Duration in hours	0-4	4-5	5-7	7-9	9-12	12-14	14-16	16-20	20-24
Demand (%)	2	1	10	28	15	5	10	19	10

(OR)

15 (b)	Discuss with neat sketches the various types of layout of distribution system and brief the advantages and disadvantages of various system.	13	5	1

PART- C (1 x 15 = 15 Marks)

(Q.No. 16 is Compulsory)

Q. No	Questions	Marks	CO	BL
16.	Design a clari-flocculator for a proposed water treatment plant with a capacity of 50 ML/d.Take viscosity as 0.89 x 10^{-3} N s/m^2,C_D = 1.8 and velocity of paddle as 0.6 m/s. Draw a neat sketch of the unit.	15	3	3