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

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)
B.E / B. Tech (Full Time) END SEMESTER EXAMINATIONS – APRIL / MAY 2024
CIVIL ENGINEERING
(Common to English & Tamil Medium)
Sixth Semester
CE 5008- GROUNDWATER ENGINEERING
(Regulation 2019)

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

PART- A (10 x 2 = 20 Marks)

Q.No	Questions	Marks	CO	BL
1.	Distinguish between specific yield and specific retention.	2	1	L2
2.	State Darcy's law and its assumptions.	2	1	L1
3.	How will you calculate the residual drawdown by Bailer method?	2	2	L2
4.	What are the functions of infiltration galleries?	2	2	L1
5.	Define groundwater model and state its applications.	2	3	L1
6.	Differentiate between model calibration and model validation.	2	3	L2
7.	How will you check the iron balance error of a water quality?	2	4	L2
8.	State the agricultural sources of groundwater pollution.	2	4	L1
9.	How seawater intrusion takes place and write the Ghyben–Herzberg equation.	2	5	L2
10.	What is meant by reclaimed wastewater recharge?	2	5	L1

PART- B (5 x 13 = 65 Marks)

Q.No	Questions	Marks	CO	BL
11.	a) (i) Derive the expression for discharge from a well in unconfined aquifer using Theim's theory.	8	1	L4
	(ii) A tube well of 30cm diameter penetrates fully in an artesian aquifer. The strainer length is 20m. Calculate the yield from the well under a drawdown of 3m. The aquifer consists of sand of effective size of 0.2mm having coefficient of permeability equal to 50m/day. Assume radius of drawdown equal to 150 meters.	5	1	L4
	OR			
	b) (i) Discuss the different types of groundwater aquifers with a neat sketch.	8	1	L3
	(ii) A 30cm well penetrates 50m below the static water table. After a long period of pumping at a rate of 1700 lpm, the drawdowns in the wells at 15m and 45m from the pumped well were 1.7 and 0.8m, respectively. Determine the transmissibility of the aquifer. What is the drawdown in the pumped well?	5	1	L4
12.	a) i) Derive the expression for unsteady radial flow into a well using Jacob's and Chow's method.	9	2	L4
	ii) Explain briefly about Slug test method for determining coefficient of transmissibility.	4	2	L3
	OR			

12. b) A variable rate well production test was conducted at Agaram, Dindigul with the results given in Table.1. Determine the coefficient of well loss and formation loss and the corresponding percentages of total drawdown in the last case by drawing the specific drawdown curve and by using equations. **13** **2** **L4**

Table.1. Results of variable rate well production tests

Step	1	2	3	4	5
Pumping rate (lpm)	1590	1980	2440	2960	3270
Resulting drawdown (m)	3.69	5.14	7.08	9.63	11.29

13. a) Explain briefly about the groundwater model development and database requirement for groundwater management. **13** **3** **L3**

OR

b) (i) Describe in detail about groundwater balance study. **5** **3** **L3**

(ii) Describe in detail about the Sensitivity Analysis and Uncertainty analysis in groundwater model. **8** **3** **L3**

14. a) i) Discuss the various criteria (any three) for the evaluation of irrigation water with permissible limits for crop growth. **7** **4** **L3**

ii) Classify the different types of groundwater pollution and explain in detail about urban pollution and industrial pollution. **6** **4** **L4**

OR

b) The chemical analysis of a water sample, obtained from a medium depth borewell in Cuddalore District, Tamilnadu at a distance of 1km from the seashore, is given below. Determine the results of Total hardness, Non-carbonate hardness, Sodium percentage, Sodium absorption ratio, Residual Carbonate and Permeability Index qualitatively. **13** **4** **L4**

Constituents	Ca	Mg	Na	HCO_3	CO_3	SO_4	Cl	TDS	TH as $CaCO_3$
Value (mg/l)	56	16	85	256	24	43	82	440	205

pH=7.5 and EC at 25^0 C=700mhos/cm

15. a) i) Write about the Soil aquifer treatment (SAT) and Aquifer Storage and Recovery (ASR) with advantages and limitations. **08** **5** **L4**

ii) Explain the salient features of groundwater legislation **05** **5** **L3**

OR

b) Describe briefly about groundwater basin management and conjunctive use of water. **13** **5** **L4**

PART- C (1 x 15 = 15 Marks)

(Q. No 16 is Compulsory)

Q.No	Questions	Marks	CO	BL
16.	With the help of neat sketches illustrate the different surface methods of artificial groundwater recharge techniques and the hydrogeological conditions where each method is recommended.	15	5	L5