Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2024
CIVIL ENGINEERING
(2020 SCHEME)

Course Code : 20CET307

Course Name: Hydrology and Water Resources Engineering

Max. Marks : 100 **Duration: 3 Hours**

Assume any data if necessary

PART A

(Answer all questions. Each question carries 3 marks)

1. Elucidate the steps involved in the determination of optimum number of rain gauges in catchment along with the equations involved.
2. Explain the use of double ring infiltrometer for measurement of infiltration.
3. Enlist the uses and limitations of unit hydrograph theory.
4. With neat sketches discuss the methods of base flow separation.
5. Explain irrigation efficiencies.
6. Define Duty and Delta. Obtain the relation between the two.
7. Enlist the factors governing the selection of site for a reservoir.
8. Define river training. Enumerate the objectives of river training.
9. State Darcy's law. Explain the significance of the law in groundwater hydrology.
10. Explain the zones of underground water.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Explain the working of Tipping bucket type rain gauge with a neat sketch. (10)

    b) The area enclosed by the adjacent isohyets of a catchment are given in table below. Determine the average depth of annual rainfall over the area. (4)

Isohyets (mm)	450-550	550-650	650-750	750-950	950-1150	1150-1250
Area (sq. km)	1200	3000	2800	1000	900	600

OR

12. a) The average annual rainfall depths recorded at 5 rain gauge stations are 910, 1070, 1410, 810 and 500 mm respectively. If the average depth of rainfall is to be estimated within 10% error, determine the additional number of gauges needed. (7)

b) If the value of k in Horton's equation is 2 and maximum and minimum infiltration rates observed are 2 cm/hr and 0.5 cm/hr respectively, find the infiltration rates at 30 minutes interval and plot the infiltration rate curve. (7)

MODULE II

13. a) The rate of rainfall for successive one hour periods of a 10hr storm were recorded as 4.0, 6.3, 5.2, 7.5, 8.4, 2.3, 5.4, 4.5, 8.5, and 3.6 cm/hr. Taking value of ϕ-index as 6.0 cm/hr, compute (i) Total Rainfall Excess (ii) w-index. (7)

b) Ordinates of 4 hr unit hydrograph are given below. Derive the ordinates of a 12 hr unit hydrograph. (7)

Time (hrs)	0	4	8	12	16	20	24	28	32	36	40	44
Ordinates of 4 hr UH (cumecs)	0	20	80	130	150	130	90	52	27	15	5	0

OR

14. a) The rate of precipitation observed over a catchment of 30 sq. km for successive 30 min are 16, 20, 24, 36, 28, 12 and 4 mm/hr. If the ϕ-index is 22 mm/hr, find the runoff volume in m^3 from the catchment. (4)

b) A 2 hr unit hydrograph ordinates for a basin are given below. Derive the ordinates of 6 hr unit hydrograph using S- curve method. (10)

Time (hrs)	0	2	4	6	8	10	12	14	16	18	20	22
Ordinates of 2 hr UH (cumecs)	0	25	100	160	200	170	110	70	30	20	8	0

MODULE III

15. a) A stream of 119 litres/s was diverted from a canal and 99 litres/s were delivered in the field. An area of 4094 acres was irrigated in 9.5 hours. The runoff loss in the field was 421 m^3. Determine the water conveyance efficiency. (4)

b) Explain the various methods of surface irrigation. (10)

OR

16. a) After how many days will you supply water to soil (clay loam) in order to ensure efficient irrigation of the given crop, if:
(i) Field capacity of soil = 27 %
(ii) Permanent wilting point = 14 %
(iii) Dry density of soil = 15 kN/m^3
(iv) Effective depth of root zone = 75 cm
(v) Daily consumptive use of water for the given crop = 11 mm (7)

b) Determine the reservoir capacity, if culturable commanded area is 5200 ha, canal losses are 20% and reservoir losses are 15%.

Crop	Base Period (days)	Duty at field (hectares/cumecs)	Intensity of irrigation
Wheat	120	1700	20%
Sugarcane	320	1400	20%
Cotton	180	1200	10%
Rice	120	700	15%

(7)

MODULE IV

17. a) Explain the types of reservoirs. (4)

b) The following information is available regarding the relationship between trap efficiency and capacity-inflow ratio for a reservoir.

Capacity/Inflow ratio	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Trap efficiency (η %)	87	93	95	95.5	96	96.5	97	97.2	97.3	97.5

(10)

Find the probable life of the reservoir with an initial reservoir capacity of 30 million cubic meters, if the annual flood inflow is 60 million cubic metres and the average annual sediment inflow is 36x10^5 kN. Assume a specific weight of sediment equal to 12 kN/m^3. The useful life of reservoir will terminate when 80% of initial capacity is filled with sediment.

OR

18. a) Describe Guide Banks and Groynes with neat sketches. (7)

b) Describe the step by step procedure for determining reservoir capacity from mass inflow curve. (7)

MODULE V

19. a) Derive an expression for steady radial flow in an unconfined aquifer. (7)

b) A 30 cm diameter well penetrates 20 m below the static water table. After 24 hours of pumping at the rate of 4000 litres/minute, water level in a test well 85 m away from the main well is lowered by (7)

0.48 m, and in a test well 35 m away from the main well, the drawdown is 1 m. Determine a) transmissibility of the aquifer b) drawdown in the main well.

OR

20. a) A tube well penetrates fully an unconfined aquifer. Calculate the discharge from the tube well under the following conditions:
Diameter of well = 30 cm
Drawdown = 2 m (7)
Effective length of strainer under the above drawdown = 10 m
Coefficient of permeability of aquifer = 0.05 cm/sec
Radius of zero drawdown = 300 m

b) Explain Recuperation test for determining yield of open wells. (7)

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