Name:

Enrolment No:

UPES

End Semester Examination, December 2023

Course: Hydrology and Water Resources Engineering **Semester: VII**

Program: B Tech Civil Engineering **Time: 03 hrs.**

Course Code: CIVL 4067 **Max. Marks: 100**

Instructions: Attempt all the questions;

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Discuss the concept of super safe structures with respect to the probable maximum precipitation.	**4**	**CO1**
Q 2	The following are the monthly pan evaporation data (Jan.-Dec.) at Krishnarajasagara in a certain year in cm: **16.7, 14.3, 17.8, 25.0, 28.6, 21.4, 16.7, 16.7, 16.7, 21.4, 16.7, 16.7** The water spread area in a lake nearby in the beginning of January in that year was 2.80 km^2 and at the end of December it was measured as 2.55 km^2. Calculate the loss of water due to evaporation in that year. Assume a pan coefficient of 0.7.	**4**	**CO2**
Q 3	The mass curve of rainfall of duration 100 min is given below. If the catchment had an initial loss of 0.6 cm and a φ-index of 0.6 cm/h, calculate the total surface runoff from the catchment. Time from start of rainfall (min): 0, 20, 40, 60, 80, 100 Cummulative rainfall (cm): 0, 0.5, 1.2, 2.6, 3.3, 3.5	**4**	**CO2**
Q 4	Highlight the importance of **drip irrigation** with reference to Indian irrigation practices.	**4**	**CO3**
Q 5	What is the classification of irrigation water having the following characteristics: Concentration of **Na, Ca and Mg** are **44, 1 and 2** milli-equivalents per litre respectively, and the electrical conductivity is **1800** micro mhos per cm at 25°C? What problems might arise in using this water on fine textured soils?	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

<table>
<tr><td>Q 6</td><td>A catchment has four sub-areas. The annual precipitation and evaporation from each of the sub-areas are given below. Assume that there is no change in the groundwater storage on an annual basis and calculate for the whole catchment the values of annual average (i) precipitation, and (ii) evaporation. What are the annual runoff coefficients for the sub-areas and for the total catchment taken as a whole?

<table>
<tr><th>Sub-Area</th><th>Area Mm^2</th><th>Annual Precipitation (mm)</th><th>Annual Evaporation (mm)</th></tr>
<tr><td>A</td><td>10.7</td><td>1030</td><td>530</td></tr>
<tr><td>B</td><td>3</td><td>830</td><td>438</td></tr>
<tr><td>C</td><td>8.2</td><td>900</td><td>430</td></tr>
<tr><td>D</td><td>17</td><td>1300</td><td>600</td></tr>
</table></td><td>10</td><td>CO1</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td>Q 6</td><td>The measured values of infiltration rate in an infiltrometer test are as follows:

<table>
<tr><td>Time (h)</td><td>0.25</td><td>0.5</td><td>0.75</td><td>1</td><td>1.25</td><td>1.5</td><td>1.75</td><td>2</td></tr>
<tr><td>Infiltration rate (cm/h)</td><td>5.6</td><td>3.2</td><td>2.1</td><td>1.5</td><td>1.2</td><td>1.1</td><td>1.0</td><td>1.0</td></tr>
</table>
Estimate the parameters of Horton’s and Phillip’s equations for infiltration and compare the computed rate of infiltration by developed equations with the observed one.</td><td>10</td><td>CO1</td></tr>
<tr><td>Q 7</td><td>The 6-h unit hydrograph of a catchment of area 259.2 km^2 is triangular in shape with a base width of 48 hours. The peak occurs at 12 h from the start. Derive the coordinates of the 6-h distribution graph for this catchment.</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 8</td><td>An analysis of annual flood series of a stream indicated the mean value and standard deviation of the flood series as 940 m^3/s and 203 m^3/s respectively. What is the magnitude of a flood of return period of 500 years in this stream? Assume that the annual flood series follow Gumbel’s distribution and the sample size is very large.</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 9</td><td>After how many days will you supply water to the soil in order to ensure sufficient irrigation of the given crop if:

F.C. = 28%
P.W.P. = 13%</td><td>10</td><td>CO3</td></tr>
</table>

	Density of soil = 1.3 g/cc **Effective depth of root zone = 700mm** **C_u = 12mm**		
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	a) Design an irrigation channel for a discharge of 100 m^3/s and silt factor 2.5 using Laceys's theory. Also, tell the limitation of Kennedy's theory. b) Design an irrigation canal for the given data: i. Discharge = **80 cumecs** ii. CVR = **1.0** iii. Longitudinal Bed slope = **1 in 2000** iv. Kutter's rugosity coefficient = **0.02**	**10 + 10**	**CO4**
OR			
Q 10	A most efficient trapezoidal section is required to give a maximum discharge of **50 cumecs.** The slope of the channel bottom is **1 in 2000**. Taking C as **60** (Chezy's constant), determine the dimensions of the channel. Also, determine the value of Manning's n taking the velocity of flow as obtained for the channel by Chezy's Equation.	**20**	**CO4**
Q 11	a) The following table shows the observed annual rainfall and the corresponding annual runoff for a small catchment. Develop the rainfall-runoff correlation equation for this catchment and find the correlation coefficient. What annual runoff can be expected from this catchment for an annual rainfall of 100 cm? b) Explain a procedure for supplementing the missing rainfall data.	**15+5**	**CO1**

Year	1964	1965	1966	1967	1968	1969
Annual Rainfall (cm)	90.5	111.0	38.7	129.5	145.5	99.8
Annual Runoff (cm)	30.1	50.2	5.3	61.5	74.8	39.9
Year	1970	1971	1972	1973	1974	1975
Annual Rainfall (cm)	147.6	50.9	120.2	90.3	65.2	75.9
Annual Runoff (cm)	64.7	6.5	46.1	36.2	24.6	20.0