

<b>Name:</b>	 <b>UPES</b> UNIVERSITY OF TOMORROW
<b>Enrolment No:</b>	

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, May 2022**

**Course: Hydrology and Water Resources Engineering** **Semester: VI**  
**Program: B Tech Civil Engineering** **Time: 03 hrs.**  
**Course Code: CIVL 3008** **Max. Marks: 100**

**Instructions: Attempt all the question**

**Set-2**

**SECTION A**  
**(5Qx4M=20Marks)**

S. No.	Question	Marks	CO
Q 1	Discuss LA NINA in context to the Indian summer monsoon rainfall. Highlight its impact on the floods.	4	CO1
Q 2	A mean annual runoff of 1 m <sup>3</sup> /s from a catchment of area 31.54 km <sup>2</sup> , represents an effective rainfall of ..... cm.	4	CO2
Q 3	Differentiate between influent and effluent stream with the help of figures.	4	CO2
Q 4	Highlight the importance of micro-irrigation schemes with reference to Indian agriculture.	4	CO3
Q 5	What is the classification of irrigation water having the following characteristics: Concentration of Na, Ca and Mg are 22, 3 and 1.5 milli-equivaleints per litre respectively, and the electrical conductivity is 200 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)**

Q 6	<p>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?</p>	<b>10</b>	<b>CO1</b>				
	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"><b>Sub-Area</b></td> <td style="width: 15%;"><b>Area Mm<sup>2</sup></b></td> <td style="width: 15%;"><b>Annual</b></td> <td style="width: 15%;"><b>Annual</b></td> </tr> </table>	<b>Sub-Area</b>	<b>Area Mm<sup>2</sup></b>	<b>Annual</b>	<b>Annual</b>		
<b>Sub-Area</b>	<b>Area Mm<sup>2</sup></b>	<b>Annual</b>	<b>Annual</b>				

		Precipitation (mm)	Evaporation (mm)		
<b>A</b>	10.7	1030	530		
<b>B</b>	3	830	438		
<b>C</b>	8.2	900	430		
<b>D</b>	17	1300	600		

OR

Q 6	A small catchment of area 150 ha received a rainfall of 10.5 cm in 90 minutes due to a storm. At the outlet of the catchment, the stream draining the catchment was dry before the storm and experienced a runoff lasting for 10 hours with an average discharge of 1.5 m <sup>3</sup> /s. The stream was again dry after the runoff event. (a) What is the amount of water which was not available to runoff due to combined effect of infiltration, evaporation and transpiration? What is the ratio of runoff to precipitation?	10	CO1
Q 7	a) A class A pan was set up adjacent to a lake. The depth of water in the pan at the beginning of a certain week was 195 mm. In that week there was a rainfall of 45 mm and 15mm of water was removed from the pan to keep the water level within the specified depth range. If the depth of the water in the pan at the end of the week was 190 mm, calculate the pan evaporation. Using a suitable pan coefficient estimate the lake evaporation in that week. b) A reservoir has an average area of 50 km <sup>2</sup> over an year. The normal annual rainfall at the place is 120 cm and the class A pan evaporation is 240 cm. Assuming the land flooded by the reservoir has a runoff coefficient of 0.4, estimate the net annual increase or decrease in the streamflow as a result of the reservoir.	10	CO2
Q 8	a) Estimate the constant rate of withdrawal from a 1375 ha reservoir in a month of 30 days during which the reservoir level dropped by 0.75 m in spite of an average inflow into the reservoir of 0.5 Mm <sup>3</sup> /day. During the month the average seepage loss from the reservoir was 2.5 cm, total precipitation on the reservoir was 18.5 cm and the total evaporation was 9.5 cm. b) A river reach had a flood wave passing through it. At a given instant the storage of water in the reach was estimated as 15.5 ha.m. What would be the storage in the reach after an interval of 3 hours if the average inflow and outflow during the time period are 14.2 m <sup>3</sup> /s and 10.6 m <sup>3</sup> /s respectively?	5+5	CO2
Q 9	800 m <sup>3</sup> of water is applied to the farmer's field of 0.6 hectares. When the moisture content falls to 40% of the available water between field capacity (36%) of soil and permanent wilting point (15 %) of the soil	10	CO3

	crop combination, determine the field application efficiency. The root zone depth of rice is 60cm. Assume porosity = 0.4																																																																										
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>																																																																											
Q 10	Design a stable channel to carry a discharge of 40 cumecs with B/D ratio as 2.5. The channel is to be laid at a slope of 1 in 4000, CVR is 1.0. Use Kutter's rugosity coefficient as 0.023.	<b>20</b>	<b>CO4</b>																																																																								
<b>OR</b>																																																																											
Q 10	A most efficient trapezoidal section is required to give a maximum discharge of 21.5 cumecs. The slope of the channel bottom is 1 in 2500. Taking C as 70 (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.	<b>20</b>	<b>CO4</b>																																																																								
Q 11	Annual rainfall and runoff values (in cm) of a catchment spanning a period of 21 years are given below.  <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Year</th> <th>Annual rainfall (cm)</th> <th>Annual runoff (cm)</th> <th>Year</th> <th>Annual rainfall (cm)</th> <th>Annual runoff (cm)</th> </tr> </thead> <tbody> <tr><td>1975</td><td>118</td><td>54</td><td>1986</td><td>75</td><td>17</td></tr> <tr><td>1976</td><td>98</td><td>45</td><td>1987</td><td>107</td><td>32</td></tr> <tr><td>1977</td><td>112</td><td>51</td><td>1988</td><td>75</td><td>15</td></tr> <tr><td>1978</td><td>97</td><td>41</td><td>1989</td><td>93</td><td>28</td></tr> <tr><td>1979</td><td>84</td><td>21</td><td>1990</td><td>129</td><td>48</td></tr> <tr><td>1980</td><td>91</td><td>32</td><td>1991</td><td>153</td><td>76</td></tr> <tr><td>1981</td><td>138</td><td>66</td><td>1992</td><td>92</td><td>27</td></tr> <tr><td>1982</td><td>89</td><td>25</td><td>1993</td><td>84</td><td>18</td></tr> <tr><td>1983</td><td>104</td><td>42</td><td>1994</td><td>121</td><td>52</td></tr> <tr><td>1984</td><td>80</td><td>11</td><td>1995</td><td>95</td><td>26</td></tr> <tr><td>1985</td><td>97</td><td>32</td><td></td><td></td><td></td></tr> </tbody> </table> <p>Analyze the data to :</p> <p>(a) Estimate the 75% and 50%dependable annual yield of the catchment</p> <p>(b) Develop a linear correlation equation to estimate annual runoff volume for a given annual rainfall value.</p>	Year	Annual rainfall (cm)	Annual runoff (cm)	Year	Annual rainfall (cm)	Annual runoff (cm)	1975	118	54	1986	75	17	1976	98	45	1987	107	32	1977	112	51	1988	75	15	1978	97	41	1989	93	28	1979	84	21	1990	129	48	1980	91	32	1991	153	76	1981	138	66	1992	92	27	1982	89	25	1993	84	18	1983	104	42	1994	121	52	1984	80	11	1995	95	26	1985	97	32				<b>10+10</b>	<b>CO1</b>
Year	Annual rainfall (cm)	Annual runoff (cm)	Year	Annual rainfall (cm)	Annual runoff (cm)																																																																						
1975	118	54	1986	75	17																																																																						
1976	98	45	1987	107	32																																																																						
1977	112	51	1988	75	15																																																																						
1978	97	41	1989	93	28																																																																						
1979	84	21	1990	129	48																																																																						
1980	91	32	1991	153	76																																																																						
1981	138	66	1992	92	27																																																																						
1982	89	25	1993	84	18																																																																						
1983	104	42	1994	121	52																																																																						
1984	80	11	1995	95	26																																																																						
1985	97	32																																																																									