Name:

Enrolment No:

UPES
UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2021

Course: Water Resources Engineering **Semester: VI**
Program: B Tech Civil Engineering **Time: 3 hours**
Course Code: CIVL 3023 **Max. Marks: 100**

Instructions: Attempt all the questions

SECTION A

1. Each Question will carry 5 Marks
2. Instruction: Complete the statement / Calculate the correct answer(s)

S. No.		Marks	CO
Q1	The normal annual rainfall at stations A, B, C, and D in a basin are **80.97, 67.59, 76.28 and 92.01 cm** respectively. In the year 1975, the station D was inoperative and the stations A, B and C recorded annual precipitations of **91.11, 72.23 and 79.89** cm respectively. Estimate the rainfall at station D in that year.	**5**	**CO1**
Q2	A reservoir has an average area of **50 km^2** 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.	**5**	**CO1**
Q3	The peak of a flood hydrograph due to a 6-h storm is 470 m^3/s. The mean depth of rainfall is 8.0 cm. Assume an average infiltration loss of 0.25 cm/h and a constant base-flow of 15 m3/s and estimate the peak discharge of the 6-h unit hydrograph for this catchment.	**5**	**CO2**
Q4	Find the delta for a crop when its duty is 4.32 km^2 per m^3/s on the field, the base period of this crop is 60 days.	**5**	**CO3**
Q5	Determine the time to irrigate a strip of land 0.1 Ha in an area from a tube-well with a discharge of 0.2 cumecs. The infiltration capacity of the soil may be taken as 0.5 cm/hr, and the average depth of flow on the field as 0.1 m.	**5**	**CO3**
Q6	Ordinates of the one hour unit hydrograph of a basin at one-hour intervals are 5, 8, 5, 3 and 1 m^3/s. Calculate the watershed area represented by this unit hydrograph.	**5**	**CO2**

SECTION B

1. Each question will carry 10 marks
2. Instruction: Write short / brief notes

<table>
<tr>
<td>Q7</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>
Also sketch the hydrological cycle shoeing these components.</td>
<td>10</td>
<td>CO1</td>
</tr>
<tr>
<td>Q8</td>
<td>The ordinates of a 6-h unit hydrograph are as given below:
<table>
<tr><td>Time (h)</td><td>0</td><td>6</td><td>12</td><td>18</td><td>24</td><td>30</td><td>36</td><td>42</td><td>48</td><td>54</td><td>60</td><td>66</td></tr>
<tr><td>ordinate of 6-h UH (m^3/s)</td><td>0</td><td>20</td><td>60</td><td>150</td><td>120</td><td>90</td><td>66</td><td>50</td><td>32</td><td>20</td><td>10</td><td>0</td></tr>
</table>
If two storms, each of 1-cm rainfall excess and 6-h duration occur in succession, calculate the resulting hydrograph of flow. Assume base flow to be uniform at10 m^3/s.</td>
<td>10</td>
<td>CO2</td>
</tr>
<tr>
<td>Q9</td>
<td>For a river, the estimated flood peaks for two return periods by the use of Gumbel’s method are as follows:
<table>
<tr><th>Return Period (Years)</th><th>Peak Flood (cumecs)</th></tr>
<tr><td>100</td><td>435</td></tr>
<tr><td>50</td><td>395</td></tr>
</table>
What flood discharge in this river will have a return period of 1000 years?</td>
<td>10</td>
<td>CO2</td>
</tr>
<tr>
<td>Q10</td>
<td>Compute the depth and frequency of irrigation required for a a certain crop with the data given below:
a) Depth of root zone = 1m
b) Field Capacity = 22%
c) Wilting point = 22%
d) Consumptive use = 25 mm /day</td>
<td>10</td>
<td>CO3</td>
</tr>
</table>

	e) Efficiency of Irrigation = 10 % f) Apparent specific gravity of soil = 1.5 Assume 50 % depletion of moisture before application of irrigation water at field capacity.		
Q11	With the help of a neat sketch explain the working of given below instruments: a) Double ring infiltrometer b) Class A pan evaporimeter	**5+5**	**CO1**
SECTION-C			
1. Each Question carries 20 Marks. **2. Instruction: Write long answer.**			
Q12	a) Design a stable canal section to carry-50 cumecs discharge at a slope of 0.25 m/km, having been given that n = 0.0225, and m = 1.00, where the symbols have their usual meaning. b) Compare Lacey's theory with Kenndy's theory. c) Design an irrigation channel section for the following data: Discharge = 30 cumecs Silt factor = 1.0 Side slopes = 0.5 :1.	**10+3+7**	**CO4**
OR			
Q12	a) 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 50 m/km. Taking C as 100 (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) Discuss the three regime conditions for canal design with respect to Lacey's theory.	**15+5**	**CO4**