U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June / July 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Civil Engineering **Duration: 3 hrs.**

Course Code: 22CV5PCHIE **Max Marks: 100**

Course: Hydrology and Irrigation Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Explain in detail with neat sketch, Horton's Engineering representation of hydrological cycle.	*CO1*	*PO1*	**10**
	b)	The average rainfall in cm at four hour existing rain gauge station in a basin are 105, 79, 70 and 66. If the average depth of rainfall over the basin is to be estimated within 10% error, determine the additional number of rain gauges required. Comment on the same.	*CO1*	*PO1*	**10**
		OR			
2	a)	List and explain with a neat sketch any two types of rain gauges.	*CO1*	*PO1*	**10**
	c)	The rainfall data for the period 1990-2008 is presented, construct a 3-year moving average curve.	*CO1*	*PO1*	**10**

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Annual rainfall (mm)	525	620	430	280	315	400	710	595	375	560
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	-
Annual rainfall (mm)	575	420	540	450	380	305	450	1025	915	-

		UNIT - II			
3	a)	With a neat sketch, explain how evaporation can be measured using IS class A pan. Also List the factors influencing the evaporation.	*CO1*	*PO1*	**10**
	b)	A 6 hour storm produced rainfall intensities of 1, 18, 25, 12, 10 and 6 mm/hr in successive one hour intervals over a basin of 800 sq.km. The resulting runoff observed as 2640 hectare-meters. Determine the Φ index for the basin.	*CO1*	*PO1*	**10**

<table>
<tr><td></td><td></td><td></td><td colspan="3">OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>4</td><td>a)</td><td>Define infiltration capacity. Explain the factors affecting infiltration capacity Also with a neat sketch, explain the procedure of finding the infiltration capacity using double ring infiltrometer.</td><td>CO1</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td>c)</td><td>An urban catchment has an area of 85 ha. The slope of the catchment is 0.006 and maximum length of travel of water is 950 m. The maximum depth of rainfall with a 25 year return period is as below.
<table>
<tr><td>Duration (min)</td><td>5</td><td>10</td><td>20</td><td>30</td><td>40</td><td>60</td></tr>
<tr><td>Depth of rainfall (mm)</td><td>17</td><td>26</td><td>40</td><td>50</td><td>57</td><td>62</td></tr>
</table>
If a culvert for drainage at the outlet of this area is to be designed for a return period of 25 years, estimate the required peak-flow rate, by assuming the runoff coefficient as 0.3.</td><td>CO1</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>List the assumption made in the unit hydrograph theory. And explain with a neat sketch the components of hydrograph.</td><td>CO1</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Following are the ordinates of a 3 hour unit hydrograph. Derive and plot the 3 hour flood hydrograph due to an excess rainfall of 4.5 cm
<table>
<tr><td>Time (hours)</td><td>0</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td><td>18</td><td>21</td><td>24</td></tr>
<tr><td>3hrs UHG ordinates (m^3/s)</td><td>0</td><td>1.5</td><td>4.5</td><td>8.6</td><td>12</td><td>9.4</td><td>4.6</td><td>2.3</td><td>0.8</td></tr>
</table></td><td>CO1</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>6</td><td>a)</td><td>Explain the term stream gauging and list the various methods available for stream gauging. With a neat sketch, explain the area-velocity method of stream gauging.</td><td>CO1</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>The stream has the trapezoidal section with base width of 10 m and side slope of 2H: 1V in a reach 1000 m. In order to compute the flood discharge in a stream by slope area method, the following data has been obtained. Estimate the discharge in the stream if the coefficient of eddy loss is 0.3 for gradual expansion and 0.1 for gradual contraction.
<table>
<tr><td>Section</td><td>Elevation of Bed (m)</td><td>Stage (m)</td><td>Remarks</td></tr>
<tr><td>Upstream</td><td>1100</td><td>1103.2</td><td rowspan="2">n = 0.03</td></tr>
<tr><td>Downstream</td><td>1097.3</td><td>1101.0</td></tr>
</table></td><td>CO1</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Define irrigation. List and explain any two types of flow irrigation. Also give its ill effects.</td><td>CO2</td><td>PO1</td><td>10</td></tr>
</table>

		b)	The base period, duty at the field of difference crops, and area under each crop in the command area are given below. Find the required reservoir capacity to cater to the needs of the crops. **Crops** / **Base period (days)** / **Duty @ field (Ha/cumec)** / **Intensity of irrigation (%)** **Wheat** 120 1800 20 **Sugar cane** 360 1700 20 **Cotton** 180 1400 10 **Rice** 120 800 15 **Vegetables** 120 700 15	*CO2*	*PO1*	**10**
			OR			
	8	a)	Define the term Water requirement of crops, Crop period, Base period and Consumptive use.	*CO2*	*PO1*	**10**
		b)	A certain crop is grown in an area of 3000 hectares which is fed by a canal system. The data pertaining to irrigation are as follows: Field capacity of soil= 26% Optimum moisture= 12 Permanent wilting point-10% Effective depth of root zone is 80 cm and Relative density of soil=1.4. If the frequency of irrigation is 10 days and the overall efficiency is 23%, find (i) the daily consumptive use (ii) The water discharge in m^2/sec required in the canal feeding the area.	*CO2*	*PO1*	**10**
			UNIT - V			
	9	a)	Explain the efficiency terms involved in achieving the more efficient irrigation.	*CO2*	*PO1*	**10**
		b)	A water course commands an irrigated area of 1000 hectares. The intensity of irrigation for rice in this area is 70%. The transplantation of rice crop takes 15days and during the transplantation period the total depth of water required by the crop on the field is 500mm. During the transplantation period , the useful rain falling on the field is 120mm. Find the duty of irrigation water for the crop on the field during transplantation, at the head of the field is and also at the head of the water course assuming losses of water to be 20% in the water course. Also calculate the discharge required in the water course.	*CO2*	*PO1*	**10**
			OR			
	10	a)	Define the following terms time factor and capacity factor, kor watering, paleo irrigation.	*CO2*	*PO1*	**10**
		b)	The gross commanded area for a distributary is 20000 hectares, 75% of which can be irrigated. The intensity of irrigation for Rabi season is 40% that for Kharif season is 10%. If kor period is 4 weeks for rabi and 2.5 weeks for rice, determine the outlet discharge. Outlet factors for rabi and rice may be assumed as 1800 hectares/ cumec and 775 hectares/ cumec. Also calculate delta for each crop.	*CO2*	*PO1*	**10**

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