U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 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.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to the evaluator will be treated as malpractice.

			UNIT - I	CO	PO	Marks
1	a)		Explain, with a neat sketch, Horton's representation of the hydrological cycle.	CO 1	PO 1	6
	b)		Explain the construction and working of Simon's rain gauge with a neat sketch.	CO 1	PO 1	6
	c)		A catchment has seven rain gauge stations. In a year, the annual rainfall recorded by the gauges are as follows: Station P Q R S T U V Rainfall (cm) 130 142.1 118.2 108.5 165.2 102.1 146.9 For a 5% error in estimating the mean rainfall, calculate the minimum number of additional rain gauges to be installed in the catchment.	CO 1	PO 1	8
			OR			
2	a)		With appropriate example, explain the term return period and its relevance in hydrology.	CO 1	PO 1	5
	b)		A precipitation station X in a catchment was inoperative for some time during which a storm occurred. At three stations A, B and C surrounding X, the total precipitation recorded during this storm are 75, 58, and 47 mm respectively. The normal annual precipitation at stations X, A, B and C are respectively 757, 826, 618, and 482 mm. Estimate the missing storm precipitation data at station X using the normal ratio method.	CO 1	PO 1	8
	c)		Define precipitation. Explain different forms and types of precipitation.	CO 1	PO 1	7
			UNIT - II			
3	a)		Define evaporation. Explain the factors affecting the same. With a neat sketch, explain the measurement of evaporation using ISI class A evaporimeter.	CO 1	PO 1	10

	b)	The mass curve of an isolated storm in a 500 ha watershed is as follows. If the direct runoff produced by the storm is measured at the outlet of the watershed as 0.340 Mm^3, eatimate the Φ index of the storm and the duration of rainfall excess.			**10**

Time from start (h)	0	2	4	6	8	10	12	14	16	18
Cumulative rainfall (cm)	0	0.8	2.6	2.8	4.1	7.3	10.8	11.8	12.4	12.6

		OR			
4	a)	Define infiltration capacity. With a neat sketch explain how infiltration capcity is measured in the field. Also explain a typical infiltration capacity curve.	***CO 1***	***PO 1***	**10**
	b)	An infiltration test was conducted by using an infiltrometer of inner ring diameter of 35 cm. The following results were recorded. Determine the infiltration rate for the given time intervals.	***CO 1***	***PO 1***	**10**
		UNIT - III			
5	a)	Explain the rational method to estimate the peak flow from a catchment.	***CO 1***	***PO 1***	**5**
	b)	A 6-hr unit hydrograph of a basin is triangular, with a peak of 100 m^3/s occurring at 24 hrs from the start, and the base period is 72 hrs. Determine the catchment area.	***CO 1***	***PO 1***	**5**
	c)	The following observations were made at a gauging site while recording stream gauge data. The rating equation of the current meter is given as $V = 0.62N_s + 0.032$ m/s, where N_s is in revolutions per second. Calculate the discharge in the stream.	***CO 1***	***PO 2***	**10**
		OR			
6	a)	Explain the elements of hydrograph with a neat sketch.	***CO 1***	***PO 1***	**8**

Time from start of test (min)	0	5	10	30	60	120	180	240	300	360
Volume of water added since start (cm^3)	0	46	90	246	435	662	842	1000	1154	1300

Distance from bank (m)	0	2	5	8	12	15	18	21	23	24
Depth (m)	0	0.6	1.2	1.8	2.4	1.9	1.4	1.1	0.5	0
current meter revolutions at 0.6 depth	0	60	90	120	150	140	100	80	50	0
Time (s)	0	150	140	140	160	140	140	140	140	0

	b)	Following are the ordinates of a storm hydrograph of a river draining a catchment area of 423 km^2 due to a 6 hr isolated storm. Derive the ordinates of a 6-hr unit hydrograph for the catchment.	***CO 1***	***PO 1***	**12**

Time from the start of storm (hr)	-6	0	6	12	18	24	30	36	42	48
Discharge (m^3/s)	10	10	30	87.5	115.5	102.5	85	71	59	47.5

Time from the start of storm (hr)	54	60	66	72	78	84	90	96	102
Discharge (m^3/s)	39	31.5	26	21.5	17.5	15	12.5	12	12

		UNIT - IV			
7	a)	Explain crop seasons in the Indian context. Also, explain any two surface water application methods to the crops with neat sketches.	***CO 2***	***PO 1***	**10**
	b)	An irrigation field 45 m wide and 265 m long has soil of apparent specific gravity 1.56 and field capacity 23%. Depth of the root zone is 0.95 m. Daily consumptive use is 11 mm and irrigation is to be started when 75% of available water is used. (i) Determine the depth of irrigation. (ii) Calculate the time required for irrigation, if discharge at the field course is 20 lit/sec.	***CO 2***	***PO 2***	**10**
		OR			
8	a)	Define irrigation and explain its necessity in a tropical country like India. List the advantages and ill-effects of assured irrigation.	***CO 2***	***PO 1***	**10**
	b)	A sandy loam soil holds water at 140 mm/m depth between field capacity and permanent wilting point. The root depth of the crop is 30 cm and the allowable depletion of water is 35%. The daily water use by the crop is 5 mm/day. The area to be irrigated is 60 ha and water can be diverted at 28 litres per second. There are no rainfall and groundwater contribution. Determine i) Allowable depletion between the irrigations ii) Frequency of irrigation iii) Net application depth of water iv) Volume of water required and v) Time to irrigate 4 ha plot.	***CO 2***	***PO 2***	**10**
		UNIT - V			
9	a)	Define duty and delta in the context of canal irrigation. Also, elaborate on the factors affecting the duty of irrigation water and explain the methods to improve duty.	***CO 2***	***PO 1***	**10**
	b)	A water course has a culturable command area of 1200 ha. Irrigation intensity for crop A is 40% and for B is 35%, and both are rabi crops. Crop A has Kor depth of 10 cm and Kor period of 20 days. Crop B has Kor depth 16 cm and Kor period 15 days. Calculate the discharge required in the water course to meet the irrigation demand.	***CO 2***	***PO 1***	**10**
		OR			

<table>
<tr><td></td><td>10</td><td>a)</td><td>Explain different type of alignments of irrigation canals. Elaborate on how the alignment, full supply level and full supply discharge of irrigation canals are fixed while planning the irrigation project.</td><td>CO 2</td><td>PO 1</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>The base period, intensity of irrigation, and duty of water for various crops under a canal system are given. Determine the reservoir capacity in million cubic meters, if the culturable command area is 8000 ha, conveyance loss is 14% and reservoir losses are 12%.
<table>
<tr><th>Crop</th><th>Base Period (days)</th><th>Duty (ha /cumecs)</th><th>Intensity of irrigation</th></tr>
<tr><td>Wheat</td><td>120</td><td>1500</td><td>35%</td></tr>
<tr><td>Sugarcane</td><td>180</td><td>1600</td><td>15%</td></tr>
<tr><td>Rice</td><td>120</td><td>900</td><td>35%</td></tr>
<tr><td>Maize</td><td>90</td><td>800</td><td>15%</td></tr>
</table></td><td>CO 2</td><td>PO 2</td><td>10</td></tr>
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