U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**

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

Course Code: 20CV6PCIWR **Max Marks: 100**

Course: Irrigation and Water Resources

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 evaluator will be treated as malpractice.

			UNIT - I	CO	PO	Marks
1	a)		(i) Illustrate the importance of drainage point in relation to water budget equation of the catchment. (ii) The normal annual precipitation of five raingauge stations P, Q, R, S and T are respectively 125, 102, 76, 113 and 137 cm. During a particular storm, the precipitation recorded by stations P, Q, R, and S are 13.2, 9.2, 6.8 and 10.2 cm respectively. The instrument at station T was inoperative during that storm. Estimate the rainfall at station T during that storm.	*CO1*	*PO 1*	**10**
	b)		In a catchment, whose shape can be approximated by a pentagon, four raingauge stations are situated inside the catchment. The coordinates of the corners of the catchment that define its boundaries and the coordinates of the four raingauge stations are given below. Also given are the annual rainfall recorded by the four stations in the year 2005. Determine the average annual rainfall over the catchment in that year by the Thiessen –mean method.	*CO1*	*PO1*	**10**

Distances are in Km. **Corner a is the origin of co-ordinates.**

Catchment Boundary	Corner	a	b	c	d	e
	Co-ordinates	(0.0)	(120,0)	(120,80)	(60,140)	(0,80)
Rain gauge Station	Station	P	Q	R	S	
	Co-ordinates	(40,20)	(80,20)	(80,60)	(40,60)	
	AnnualRainfall, cm	120	110	100	125	

			OR			
2	a)		Explain Horton's qualitative representation of hydrologic cycles with the help of diagram.	*CO1*	*PO1*	**10**
	b)		A lake had a water surface elevation of 103.200 m above datum at the beginning of a certain month. In that month, the lake received an average inflow of 6.0 m^3/s from surface runoff sources. In the same	*CO1*	*PO1*	**10**

			period, the outflow from the lake had an average value of 6.5 m^3/s. Further, in that month, the lake received a rainfall of 145 mm and the evaporation from the lake surface was estimated as 6.10 cm. Write the water-budget equation for the lake and calculate the water surface elevation of the lake at the end of the month. The average lake-surface area can be taken as 5000 ha. Assume that there is no contribution to or from the groundwater storage.			
			UNIT - II			
3	a)		A KRS reservoir had an average surface area of 20 km^2 during June 2022. In that month the mean rate of inflow = 10 m^3/s, outflow = 15 m^3/s, monthly rainfall = 10 cm and change in storage = 16 million m^3. Assuming the seepage losses to be 1.8 cm, estimate the evaporation in that month.	*CO2*	*PO1*	**10**
	b)		Results of an infiltrometer test on a soil are given below. Determine the Horton's infiltration capacity equation for this soil.	*CO2*	*PO1*	**10**

Time since start in (h)	0.25	0.70	0.75	1.00	1.25	1.50	1.75	2.00
Infiltration capacity in cm/h	6.4	4.6	3.0	2.1	1.5	1.3	1	1

		OR				
4	a)	A storm with 12 cm of precipitation produced a direct runoff of 6.8 cm. The duration of the rainfall was 16 hours and its time distribution is given below. Estimate the ϕ-index of the storm.	*CO2*	*PO1*	**10**

Time from start (hr)	0	2	4	6	8	10	12	14	16
Cumulative rainfall (cm)	0	0.9	2.1	3.9	6.7	8.5	9.9	10.9	12.0

	b)	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 120 cm?	*CO2*	*PO1*	**10**

Year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Annual Rainfall (cm)	92	111	40	130	146	100	150
Annual Runoff (cm)	32	50	6	62	75	40	70

		UNIT - III				
5	a)	Explain in detail bubble gauge stage recorder. Also list advantages of using automatic stage recorders over manual stage recorders.	*CO3*	*PO1*	**10**
	b)	During a flood flow, the depth of water in a 12 m wide rectangular channel was found to be 3.1 m and 2.9 m at two sections 300 m apart. The drop in the water-surface elevation was found to be 0.20 m. Assuming Manning's coefficient to be 0.025, estimate the flood discharge through the channel.	*CO3*	*PO1*	**10**
		OR				

	6	a)	Explain stage-discharge relationship and its significance in hydrological modelling.	*CO3*	*PO1*	**10**
		b)	The data pertaining to a stream-gauging operation at a gauging site are given below. The rating equation of the current meter is $v = 0.51 N_s + 0.03$ m/s where N_s = revolutions per second. Calculate the discharge in the stream.	*CO3*	*PO1*	**10**

Distance from left water edge	0	1	3	5	7	9	11	12
Depth (m)	0	1.1	2.0	2.5	2.0	1.7	1	0
Revolutions of a current meter kept at 0.6 depth	0	39	58	112	90	45	30	0
Duration of observation (secs)	0	100	100	150	150	100	100	0

			UNIT - IV			
	7	a)	Differentiate between free flooding and border flooding with the help of diagrams.	*CO4*	*PO1*	**10**
		b)	Discuss the measures to be taken while deciding on reservoir site.	*CO4*	*PO1*	**10**
			OR			
	8	a)	Explain advantages and disadvantages of irrigation projects in Indian context.	*CO4*	*PO1*	**10**
		b)	Comment on functionality of various storage zones of reservoir with the help of neat diagram.	*CO4*	*PO1*	**10**
			UNIT - V			
	9	a)	Explain Base period, Delta and duty of the water. Also, derive the relationship between the terms.	*CO5*	*PO1*	**10**
		b)	A stream of 1300 litres per second was diverted from a Sardar Sarovar canal and 1000 litres per second were delivered to the field. An area of 16 hectares was irrigated in 8 hours. The effective depth of the root zone was 1.7 m. The runoff loss in the field was 4200m^3. The depth of water penetration varied linearly from 1.7m at the head end of the field to 1.1m at the tail end. Available moisture holding capacity of the soil is 20 cm per metre depth of the soil. It is required to determine (i) water conveyance efficiency, (ii) water application efficiency, (iii) water storage efficiency, and (iv) water distribution efficiency. Irrigation was started at a moisture extraction level of 30% of the available moisture.	*CO5*	*PO1*	**10**
			OR			
	10	a)	Explain various types of irrigation efficiencies in detail.	*CO5*	*PO1*	**10**
		b)	After how many days will you supply water to soil in order to insure sufficient irrigation of the given crop if – i) Field capacity of soil = 28% , ii) Permanent melting point = 12% , iii) Density of soil = 1.3 gm/cc , iv) Effective depth of root zone = 70 cm , v) Daily consumptive use of water for given crop = 12 mm. Assume readily available moisture as 80% of available moisture.	*CO5*	*PO1*	**10**

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