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.
Branch: Civil Engineering
Course Code: 20CV6PCIWR
Course: Irrigation and Water Resources

Semester: VI
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer 5 full questions choosing one full question from unit.
2. Assume missing data suitably.
3. Draw neat sketches wherever necessary.
4. Additional normal graph sheets may be supplied.

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)	Interpret Horton's engineering representation of the global hydrologic cycle process with a neat sketch.	*CO1*	*PO1*	**05**
	b)	A lake had a water surface elevation of 109.950 m above datum at the beginning of certain month. In that month the lake reserved an average inflow of 7.05 cumecs (m^3/s) from surface runoff sources. In the same period outflow from the lake have an average value of 6.75 cumecs. Further in that month the lake received a rainfall of 156 mm and evaporation from lake surface was estimated at 8.10 cm. Write the water budget equation for lake and calculate the water surface elevation of the lake at the end of the month. The average lake surface area may be taken as 4500 hectares. Assume that there is no contribution to or from ground water storage.	*CO1*	*PO1*	**07**
	c)	The recorded rainfall at 4 rain gauge stations in a catchment for a period of 9 years is given below. Estimate the missing rainfall at station X in the year 2013 by normal ratio method.	*CO1*	*PO1*	**08**

Year	Annual Rainfall in cm at 4 rain gauge stations			
	A	B	C	X
2010	50.2	56.8	60.8	52.1
2011	75.8	74.8	77.2	78.3
2012	103.5	100.9	105.4	104.5
2013	42.6	40.8	45.9	**Missing Data**
2014	56.9	52.4	60.7	63.9
2015	77.9	69.7	80.9	75.9
2016	68.5	52	65.8	70.5
2017	66.8	68.8	67.5	70.9
2018	92.5	88	95.8	90.4
2019	100.2	89.5	103.8	101.6

		OR			
2	a)	Illustrate the importance of drainage point in relation to water budget	*CO1*	*PO1*	**05**

equation of the catchment.

Q.No		Question	CO	PO	Marks
	b)	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 at 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*	*PO1*	**05**
	c)	In a catchment, whose shape can be approximated by a pentagon, four raingauge stations are present. 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 at the four stations in the year 2005. Determine the average annual rainfall over the catchment in that year by the Thiessen mean method.	*CO1*	*PO2*	**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)	(40,80)	
	Annual Rainfall, cm	120	110	100	125	

UNIT - II

Q.No		Question	CO	PO	Marks
3	a)	Define evaporation. List the factors affecting evaporation. Illustrate the ISI standard pan for measuring evaporation.	*CO2*	*PO1*	**10**
	b)	The following observations were made from a double ring infiltrometer. Plot the infiltration capacity curve and determine the average infiltration rate for the first 25 minutes of the experiment.	*CO2*	*PO1*	**10**

Time (hr)	5	10	15	25	45	60	75	90	110	130
Cumulative infiltration depth (cm)	1.72	3.2	3.97	5.56	7.35	8.3	9.43	10.2	11.28	12.36

OR

Q.No		Question	CO	PO	Marks
4	a)	A storm over a catchment area of 5 sqkm had a duration of 14 hrs. The mass curve of rainfall of the storm is as follows:	*CO2*	*PO2*	**10**

Time from start of the storm (hr)	0	2	4	6	8	10	12	14
Accumulated rainfall (cm)	0	0.6	2.8	5.2	6.6	7.5	9.2	9.6

If the φ (phi) index is 0.4cm/hr, determine the effective rainfall hyetograph and the volume of direct runoff from the catchment due to the storm.

Q.No		Question	CO	PO	Marks
	b)	Illustrate the various components of a hydrograph. Elaborate on methods of base flow separation and computation of the unit hydrograph ordinates.	*CO2*	*PO1*	**10**

	Q		Question	CO	PO	Marks
			UNIT - III			
	5	a)	Explain what is meant by stream gauging and list the various methods available for stream gauging. With a neat sketch, explain the area-velocity method of stream gauging.	*CO3*	*PO1*	**10**
		b)	The following observations were made at gauging site while recording stream gauge data. The rating equation of the current meter is $V=0.31N_s +0.75$ m/s, where N_s is in revolutions per second. Calculate the discharge in the stream.	*CO3*	*PO1*	**10**

Distance from left water edge (m)	0	1.0	3.0	5.0	7.0	9.0	11.0	12.0
Depth (m)	0	1.4	2.2	2.0	2.5	1.8	1.0	0
Revolutions of the current meter at a depth of 0.6m	0	35	63	52	108	39	30	0
Duration of observations (s)	0	98	100	100	150	95	100	0

OR

	Q		Question	CO	PO	Marks
	6	a)	The following data were collected during a stream-gauging operation in a river. Compute the discharge.	*CO3*	*PO1*	**10**

Distance from left water edge(m)		0	1.5	3	4.5	6	7.5	9
Depth (m)		0	1.3	2.5	1.7	10	0.4	0
Velocity (m/s)	At 0.2 depth	0	0.6	0.9	0.7	0.6	0.4	0
	At 0.8 depth	0	0.4	0.6	0.5	0.4	0.3	0

	Q		Question	CO	PO	Marks
		b)	During a flood flow, 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**
			UNIT - IV			
	7	a)	Illustrate a typical Area-Elevation-Capacity curve and discuss its relevance in reservoir planning and operations.	*CO4*	*PO1*	**06**
		b)	For the following conditions, select the suitable method of irrigation and justify the same with schematic diagrams and technical features. i) Hilly terrain with steep slope ii) Arecanut Plantations with silt soil	*CO4*	*PO1*	**06**
		c)	Discuss the engineering and hydrological investigations essential during the reservoir planning	*CO4*	*PO1*	**08**
			OR			
	8	a)	Differentiate between free flooding and border flooding with the help of diagrams.	*CO4*	*PO1*	**05**
		b)	Discuss the disadvantages of irrigation projects in the Indian context.	*CO4*	*PO1*	**05**
		c)	Comment on functionality of various storage zones of reservoir with the help of neat diagram.	*CO4*	*PO1*	**10**
			UNIT - V			
	9	a)	A water course has culturable command area (CCA) of 2650 hectares, out of which the intensities of irrigation for perennial sugarcane and rice crops are 20% and 40% respectively. The duty for these crops at the head of water course are 1500 hectares/cumec and 1850 hectares/cumec	*CO5*	*PO1*	**10**

			respectively. Determine the discharge required at the head of the water course if the peak demand is 140% of the average requirement.			
		b)	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 culturable command area is 6000 hectares. The conveyance loss is 12% and reservoir losses are 10%.	*CO5*	*PO2*	**10**
			OR			
	10	a)	The following data is observed in an irrigation field: - Field Capacity of soil =27% - Permanent Wilting Point= 14% - Dry Density of soil = 15 kN/m^3 - Effective depth of root zone= 75 cm - Daily consumptive use of water for the given crop =11 mm Determine the frequency of irrigation to ensure efficient irrigation.	*CO5*	*PO2*	**10**
		b)	Differentiate between Gross Irrigation Requirement and Net Irrigation Requirement. Enumerate the steps involved in calculating Gross Irrigation Requirement for a command area	*CO5*	*PO1*	**10**

Table for 9 b):

Crop	Base Period (days)	Duty of field (Hectares/cumec)	Intensity of Irrigation
Wheat	120	1800	25%
Sugar cane	180	1700	25%
Rice	120	800	35%
Maize	90	900	15%

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