U.S.N.										

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

Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary 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)	Long term rainfall data has been recorded at a station located in the Lalbagh Botanical Garden in Bengaluru. However, the instrument was damaged in the year 2023 and could not measure the rainfall during that year. The instrument needs to be replaced. (i) Describe with a neat sketch the construction of the standard non-recording type rain gauge for the station. (ii) Explain how the missing data of 2023 can be supplemented.	*CO 1*	*PO 1*	**10**
	b)	The maximum values of 24 hours summer precipitation at a rain gauge station expressed in cm from the year 2000 to 2015 are indicated below. Estimate the maximum precipitation having a recurrence interval of 5 years. Year: 2000 2001 2002 2003 2004 2005 2006 2007 Precipitation (cm): 10.7 11.2 10.8 9.6 14.9 9.7 11.3 11.6 Year: 2008 2009 2010 2011 2012 2013 2014 2015 Precipitation (cm): 11.9 12.4 17.1 17.7 16.9 15.4 13.8 12.9	*CO 1*	*PO 2*	**10**
		OR			
2	a)	The mass curve of precipitation resulted from a storm is given below. Plot the hyetograph of the storm and determine the maximum intensity in cm/hr. Hours: Min: 22:00 22:05 22:10 22:15 22:20 22:25 Cumulative rainfall (mm): 0 10.2 20.8 33.0 47.2 55.8 Hours: Min: 22:30 22:35 22:40 22:45 22:50 Cumulative rainfall (mm): 64.0 71.6 78.8 85.4 91.4	*CO 1*	*PO 1*	**10**
	b)	A catchment area is pentagonal in shape comprising a square ABCD with sides of 16 km and an equilateral triangle ADE. Rain gauges A, B, C, D, and E are positioned at the corners of the catchment, while another gauge, F, is at the center of the square.	*CO 1*	*PO 2*	**10**

			Over the course of a year, rainfall measurements were recorded as follows: 10 cm at station A, 15 cm at station B, 8 cm at station C, 6 cm at station D, 9 cm at station E, and 12 cm at station F. Using the Thiessen polygon method, determine the average rainfall over the entire catchment.			
			UNIT - II			
3	a)		Discuss the factors affecting infiltration capacity of an area.	***CO 1***	***PO 1***	**5**
	b)		A reservoir with a surface area of 300 hectares has the following average meteorological values during a given week. Water temperature is 30°C, relative humidity is 50%, wind speed at 1 m above ground = 12 km/h. Saturation vapour pressure at 30°C is 31.82 mm of Hg. Assuming deep water body (K_m = 0.36), estimate the average daily evaporation from the reservoir using Meyer's formula.	***CO 1***	***PO 1***	**5**
	c)		Infiltration data obtained in a flooding type infiltration test is given below. (i) Calculate the infiltration capacity at the given time intervals. (ii) Calculate the average infiltration capacity for the first 15 minutes of the storm. Time since start (min): 5, 10, 15, 25, 45 Cumulative infiltration depth (cm): 1.75, 3.0, 3.95, 5.50, 7.25 Time since start (min): 60, 75, 90, 110, 130 Cumulative infiltration depth (cm): 8.30, 9.30, 10.20, 11.28, 12.36	***CO 1***	***PO 1***	**10**
			UNIT - III			
4	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 in shape with a peak of 100 m^3/s occurring at 24 hrs from the start, and the base period is 72 hrs. (i) Determine the catchment area (ii) Calculate the peak flow and base period of the direct runoff hydrograph due a storm of rainfall excess 2.0 cm, lasted for 6 hrs.	***CO 1***	***PO 1***	**5**
	c)		During a high flow, water surface elevations of a small stream were noted at two sections A and B, 10 km apart (A is upstream of B). These elevations and other salient hydraulic properties are given below. Ignore the eddy losses in the channel. Assume Manning's roughness coefficient for the channel as 0.020. Estimate the discharge in the stream. A: Water surface elevation 104.771 m; Cross sectional area 73.293 m^2; Hydraulic radius 2.733 m B: Water surface elevation 104.500 m; Cross sectional area 93.375 m^2; Hydraulic radius 3.089 m	***CO 1***	***PO 2***	**10**

			OR			
5	a)	The following are the ordinates of a direct runoff hydrograph from a catchment of 15 sq. km, due to a storm of 3 hr duration. Derive the ordinate of a 3 hr unit hydrograph. Time (hours) 0 2 4 6 8 12 16 20 Flow (m^3/s) 0 1.22 4.05 6.75 5.67 3.375 1.35 0	***CO 1***	***PO 1***	**10**
	b)	Compute the streamflow for the measurement data given below. Distance from the left bank (m) 0 0.6 1.2 1.8 2.4 Depth (m) 0 0.3 1.29 2.16 1.68 Velocity (m/s) at 0.6d 0 0.42 0.57 0.78 0.75 Distance from the left bank (m) 3.0 3.6 4.2 4.8 5.4 Depth (m) 1.41 1.05 0.63 0.42 0 Velocity (m/s) at 0.6d 0.69 0.63 0.54 0.45 0	***CO 1***	***PO 2***	**10**
		UNIT - IV			
6	a)	Explain the crop seasons in the Indian context.	***CO 2***	***PO 1***	**5**
	b)	Discuss drip irrigation system stating its importance and challenges in the Indian context.	***CO 2***	***PO 1***	**5**
	c)	A sandy loam soil holds water at 180 mm/m depth between field capacity and permanent wilting point. The root depth of the crop is 40 cm. Irrigation is required when the moisture content depletes by 30% of the moisture holding capacity of the root zone. Consumptive use of the crop is 7 mm/day. If the area to be irrigated is 50 ha. and water is delivered at 140 litres per second. Estimate (i) the frequency of irrigation and (ii) time required to irrigate the area.	***CO 2***	***PO 2***	**10**
		UNIT - V			
7	a)	Explain with a neat sketch the layout of a canal system carrying water from a barrage.	***CO 2***	***PO 1***	**5**
	b)	The gross command area for a distributary is 6000 ha, 80% of which is culturable irrigable. The intensity of irrigation for rabi season is 50%. If the average duty at the head of the distributary is 2000 ha/cumec for rabi season, calculate the discharge required at the head of the distributary for the rabi season.	***CO 2***	***PO 1***	**5**
	c)	A reservoir is proposed to be constructed to command an area of 1,20,000 ha. It is anticipated that the intensity of irrigation for sugarcane and paddy are 20% each, and for rabi crops it is 50%. Duty of paddy, sugarcane and rabi crops are 864 ha / cumec, 2600 ha/cumec and 3464 ha/cumec, respectively. Delta of the crops are 120 cm, 90 cm and 40 cm respectively for paddy, sugarcane and rabi crops. Assume canal losses as 25 % of the head discharge and reservoir evaporation and dead storage losses are 20% of the gross storage. (i) Estimate the storage (in ha-m) for the reservoir required to irrigate this area. (ii) Estimate the canal capacity in the head reaches.	***CO 2***	***PO 2***	**10**

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