Ref. No. Ex/CON/PC/B/T/315/2024

B.E. CONSTRUCTION ENGINEERING THIRD YEAR FIRST SEMESTER EXAM 2024

SUBJECT: WATER RESOURCES & IRRIGATION ENGG

Time : Three Hours **Full Marks : 100**

Use Separate Answer scripts for each Part

Part - I (Marks : 50)

Answer all questions

1. (i) Briefly describe the operation of a S.S.F with neat sketches of its construction along with under drainage system (ii) Make comparison between slow and rapid gravity filters.

OR

Design a rapid sand filter to treat 20.50 million litres of raw water per day allowing 0.56% of filtered water for backwashing. Half hour per day is used for backwashing. Assume necessary data.
(ii) Draw the flow diagram of a water treatment plant for a medium sized municipal town having a river as the source of water supply?

OR

With chemical equations involved, briefly describe the process of coagulation. (6.5+6)

2. (i) What do you mean by population equivalent? State the factors which directly affect the per capita demand in a community.

(ii) Predict the population for the years 1981, 1991, 1994, and 2001 from the following census figures of a town by different methods.

Year	1901	1911	1921	1931	1941	1951	1961	1971
Population: (thousands)	60	65	63	72	79	89	97	120

OR

Design a rectangular sedimentation tank to treat 2.500 million litres of raw water per day. The detention period may be assumed to be 3 hours. (5+7.5)

[Turn over

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3. (i) A stable channel is to be designed for a discharge of 40 m^3/s and the silt factor of unity. Calculate the dimensions of the channel using Lacey's regime equations. What would be the bed-width of this channel if it were to be designed on the basis of Kennedy's method with critical velocity ratio equal to unity and the ratio of bed-width to depth of flow the same as obtained from Lacey's method.

OR

For the design of an irrigation channel through a flat ground it has been decided to avail fully the available slope of 25 cm/km, and adopt Lacey's method of design by restricting the discharge. Design the channel taking the average size of bed material as 0.0005 m and side slope of 0.5 *H*: 1V.

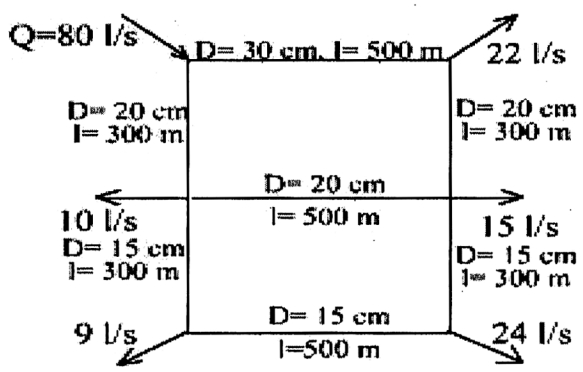
(ii) What are the "true regime" conditions in an alluvial channel as stipulated by Lacey?

(iii) Compare between Lacey's and Kennedy's theory? (6+3+3.5)

4. (i) Describe the principle of Hardy cross method.

(ii)What are the different types of cross drainage works?

(iii) Calculate the head losses and the corrected flows in the various pipes of a distribution network as shown in figure. The diameters and the lengths of the pipes used are given against each pipe. Compute corrected flows after one corrections.



OR

Define river training work? Enumerate step by step the design procedure of Guide bank as per IS: 10751-1994. (2.5+2.5 +7.5)

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Part - II (Marks : 50)

	No. of Questions		Marks
		Answer Q. No. 1 and any TWO from the rest.	
CO2	Q.1.I)	a) What is 'Hydrological Cycle'? i. Processes involved in the transfer of moisture from sea to land. ii. Processes involved in the transfer of moisture from sea back to sea again. iii. Processes involved in the transfer of water from snowmelt in mountains to sea. iv. Processes involved in the transfer of moisture from sea to land and back to sea again. b) How is the average velocity along the vertical in a wide stream obtained? i. By averaging the velocities at 0.2 and 0.8 depth from surface. ii. By measuring velocity at 0.6 depth below the surface. iii. By measuring velocity at half the surface. iv. By measuring velocity at 0.1 times the depth below the surface. c) The Thiessen polygon is: i. A polygon obtained by joining adjoining raingauge stations ii. A representative area used for weighing the observed station precipitation iii. An area used in the construction of depth area curves. iv. The descriptive term for shape of a hydrograph. d) The parameters in Horton's infiltration equation [$f(t) = f_c + (f_0 - f_c) e^{-kt}$] are given as, $f_0 = 7.62$ cm/hour, $f_c = 1.34$ cm/hour	1 x 5

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Part - II (Marks : 50)

	No. of Questions		Marks
		and k = 4.182/ hour. For assumed continuous ponding the cumulative infiltration at the end of 2 hours is: i. 2.68 cm ii. 1.50 cm iii. 1.34 cm iv. 4.18 cm e) "In case of moderate rain of uniform intensity, the W_{index} will be higher than Φ_{index} " – Write whether this statement is TRUE or FALSE.	
CO2	Q.1.II)	Write short notes on the following: a) Rain gauges b) Optimum number of rain gauges c) Compactness coefficient d) Unit hydrograph theory e) Estimation of missing rainfall data	1 x 5
CO2	Q.2a.	What do you mean by W_{index} and Φ_{index}? Explain giving suitable sketches wherever necessary.	5
	Q.2b.	Five rain gauges are located on a basin as shown in figure. The rainfall at stations A, B, C, D and E are 10 cm, 8 cm, 11 cm, 12 cm and 9 cm respectively. What is the mean rainfall over the basin using Thiessen Polygon method?	15

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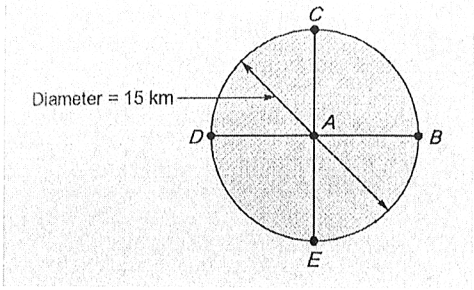
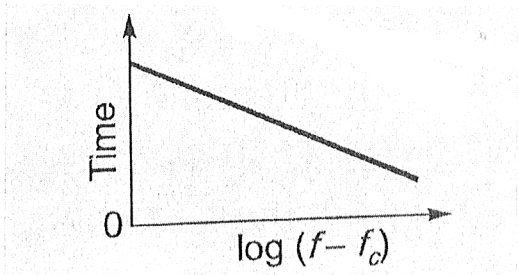
	No. of Questions		Marks
			
CO4	Q.3a.	If the slope of infiltration capacity curve as shown in figure is -0.4605, find the value of the constant k (i.e., the rate of decay of the difference between initial and final infiltration rate) in the Horton's equation of infiltration capacity curve. 	10
	Q.3b.	The number of revolutions of a current meter in 50 seconds were found to be 12 and 30 corresponding to the velocities of 0.25 and 0.46 m/s respectively. What velocity (in m/s) would be indicated by 50 revolutions of that current meter in one minute?	10
CO3	Q.4a	What is recurrence interval of time? Explain giving suitable example.	5
	Q.4b	The ordinates of a one-hour unit hydrograph at sixty minute interval are: 0, 3, 12, 8, 6, 3 and 0 m^3/s. A two-hour storm of 4cm excess rainfall occurred in the basin from 10 AM. Considering constant base flow of 20 m^3/s,	15

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Part - II (Marks : 50)

	No. of Questions		Marks
		determine the flow of the river (expressed in m^3/s) at 1 PM. Plot the hydrographs on graph paper.	