Code No: 185CR **R22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January - 2025
HYDROLOGY AND WATER RESOURCES ENGINEERING
(Civil Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) Part- A for 10 marks, ii) Part - B for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of ten questions (numbered from 2 to 11) carrying 10 marks each. From each unit, there are two questions and you should answer one of them. Hence, you should answer five questions from Part-B.
- **Draw neat and clean sketches wherever necessary. Assume suitable data wherever necessary.**

PART- A

(10 Marks)

1.a)	What is residence time in hydrologic cycle?	[1]
b)	Which type of raingauge is used as standard recording type raingauge in India?	[1]
c)	What factors influence the rate of evaporation?	[1]
d)	What is φ-Index?	[1]
e)	Define unit hydrograph.	[1]
f)	What is rising limb of hydrograph?	[1]
g)	What is aquifuge?	[1]
h)	Define drawdown.	[1]
i)	What is *kor* period?	[1]
j)	What are the disadvantages of earthen channels?	[1]

PART – B

(50 Marks)

2.a) Briefly describe the procedures to calculate the intensity-duration-frequency relationship for any given station.

b) The isohyets due to a storm in a catchment were drawn in figure and the area of the catchment bounded by isohyets were tabulated as below.

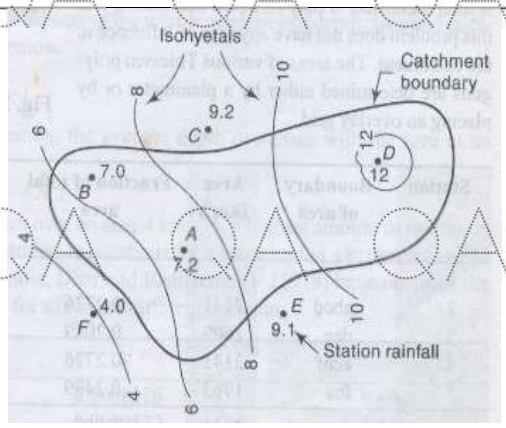

Fig. . Isohyetals of a storm

Isohyets (cm)	Area (km^2)
Station – 12.0	30
12.0 – 10.0	140
10.0 – 8.0	80
8.0 – 6.0	180
6.0 – 4.0	20

Estimate the mean precipitation due to the storm. [5+5]

OR

3.a) Write a short note on water budget equation.

b) Test the consistency of the 22 years of data of the annual rainfall measured at Ghanpur station. Rainfall data for Ghanpur station as well as the average annual rainfall measured at a group of eight neighbouring stations located in a meteorologically homogeneous region are given below.

Year	Annual Rainfall of Ghanpur (mm)	Average Annual Rainfall of 8 station groups (mm)	Year	Annual Rainfall of Ghanpur (mm)	Average Annual Rainfall of 8 station groups (mm)
1946	177	143	1957	158	164
1947	144	132	1958	145	155
1948	178	146	1959	132	143
1949	162	147	1960	95	115
1950	194	161	1961	148	135
1951	168	155	1962	142	163
1952	196	152	1963	140	135
1953	144	117	1964	130	143
1954	160	128	1965	137	130
1955	196	193	1966	130	146
1956	141	156	1967	163	161

i) In what year is a change in regime indicated?

ii) Adjust the recorded data at Ghanpur and determine the mean annual rainfall. [3+7]

4.a) Write a short note on interception.

b) The land use and soil characteristics of a 5000 ha watershed are as follows:

Soil: Not a black soil. *Hydrologic soil classification:* 60% is Group B and 40% is Group C

Land use:

Hard surface areas	Waste land	Orchard (without understory cover)	Cultivated (Terraced) poor condition
10%	5%	30%	55%

Antecedent rain: The total rainfall in past five days was 30mm. The season is dormant season.

i) Compute the runoff volume from a 125 mm rainfall in a day on the watershed.

ii) What would have been the runoff if the rainfall in the previous 5 days was 10 mm?

iii) If the entire area is urbanised with 60% residential area (65% average impervious area), 10% of paved streets and 30% commercial and business area (85% impervious), estimate the runoff volume under AMC-II condition for one day rainfall of 125 mm.

[5+5]

OR

5.a) Discuss in brief the Colorado sunken pan and Energy Budget method of measurement of evaporation.

b) What are the essential characteristics a flow duration curve should have? [5+5]

6.a) Briefly describe the factors affecting flood hydrograph.

b) Given below are observed flows from a storm of 6-hr duration on a catchment area of 500 km^2.

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66	72
Observed flow (m^3/sec)	0	100	250	200	150	100	70	50	35	25	15	5	0

Assuming the base flow to be zero, derive the ordinates of the 6-hr unit hydrograph.

[5+5]

OR

7.a) What is an IUH? What are its characteristics?

b) A 1-hr unit hydrograph is rectangular in shape with a base of 3 hours and peak of 100 m^3/sec. Develop the DRH due to an ERH given below. [4+6]

Time since start (hr)	1	2	3
Excess Rainfall (cm)	3	0	5

8.a) Derive the steady state radial flow equation to a Well in an unconfined aquifer.

b) A field test for permeability consists in observing the time required for a tracer to travel between two observation wells. A tracer was found to take 10 hr to travel between two wells 50 m apart when the difference in the water-surface elevation in them was 0.5 m. The mean particle size of the aquifer was 2 mm and the porosity of the medium 0.3. If v = 0.01 cm^2/sec estimate (i) the coefficient of permeability and intrinsic permeability of the aquifer and, (ii) the Reynolds number of the flow. [5+5]

OR

9.a) How the quality of water affects the irrigation process?

b) Differentiate between furrow irrigation and sprinkler irrigation methods.

c) For the following data pertaining to a cultivated land, determine irrigation interval and amount of irrigation water needed at each irrigation so that the moisture content at any stage does not fall below 40% of the maximum available moistures. [3+3+4]

Field capacity of soil = 30% Permanent wilting point = 12%

Porosity of soil = 0.42 Depth of root zone soil = 1.20 m

Consumptive use = 12 mm per day Application efficiency = 60%

10.a) Derive the Perimeter-Discharge relation, V-Q-f relation of Lacey's theory.

b) Design an irrigation channel in alluvial soil according to Lacey's theory with full supply discharge as 15cumecs, f = 1.0, channel side slopes as 1.5:1. [5+5]

OR

11.a) What are the causes of waterlogging?

b) How to control waterlogging?

c) A certain stretch of a lined trapezoidal channel has one side vertical wall and the other 45° slopping wall. It is to deliver water at 40 m^3/*sec* with a velocity of 1.25 *m*/*sec*. Compute bed width and flow depth for minimum lining area. [3+3+4]

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