2023

WATER RESOURCE ENGINEERING

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. a) What are the different methods available for determining mean rainfall over a catchment? — 10

   b) Raingauge station X did not function for a part of a month during which a storm occurred. The storm produced rainfall of 84, 70 and 96 mm at three surrounding stations A, B and C respectively. The normal annual rainfalls at the stations X, A, B and C are 770, 882, 736 and 944 mm respectively. Estimate the missing rainfall at station X. — 10

2. a) Define inconsistency in rain fall data. How inconsistency in rain fall data can be rectified? — 5+5=10

   b) Describe the relationships between depth, area and duration for a rainfall over an area of a given duration? — 10

3. a) What are the different techniques available for measuring the stream flow? How the measurement of stage of a river can be determined? — 2+8=10

   b) The following table gives the data obtained by a stream-gauging operation. The rating equation of the current meter is $v = 0.51N_s + 0.03$ m/s where N_s = revolutions per second. Calculate the discharge in the stream. — 10

Distance from bank (m)	0	1.0	3.0	5.0	7.0	9.0	11.0	12.0
Depth(m)	0	1.1	2.0	2.5	2.0	1.7	1.0	0
Revolutions of a current meter kept at 0.6 m depth	0	39	58	112	90	45	30	0

Duration of observation (s)	0	100	100	150	150	100	100	0

4. a) Discuss various factors affecting the distribution of runoff. 10

   b) What is hydrograph? Explain the different components of a flood hydrograph with the help of a sketch. 2+8=10

5. a) The flood data and base flow in a stream is estimated as shown in the Table below. The catchment area is 600 km^2. Estimate the rainfall excess. 10

Time in days	0	1	2	3	4	5	6	7	8	9
Total discharge (m^3/s)	20	63	151	133	90	63	44	29	20	20
Base flow (m^3/s)	0	41	126	105	62	37	21	80	0	0

   b) What are the assumptions made in the Unit Hydrograph Theory? Describe the various factors affecting the flood hydrograph. 3+7=10

6. a) What are the sources of ground water flow? What is the difference between infiltration and percolation? 2+3=5

   b) Describe briefly how the water table changes in different conditions? 5

   c) Describe the different aquifer properties? 10

7. Write short notes on any two of the following 4x5=20

   a) Evapotranspiration

   b) Raingauge

   c) Darcy's Law

   d) Unit hydrograph