



KERALA AGRICULTURAL UNIVERSITY
B.Tech. (Agrl. Engg.) 2021 Admission
III Semester Final Examination – February 2023

Lwre.2104

Watershed Hydrology (2+1)

Marks: 50
Time: 2 hours

I Fill in the blanks (10x1=10)

1. Hydrology deals with
2. Rain-gauges are erected over the ground surface with their rim at cm above ground surface.
3. An index of wetness of 40% in a certain area indicates a year with a rainfall deficiency of%.
4. The 3-hour unit hydrograph gives a net rain of cm on the entire basin, for the rainfall duration of hours.
5. The ground water contribution to the discharge in a stream is called

State True or False

6. A mass curve of rainfall need not always be a rising curve.
7. Unit hydrographs should be used for basins, larger than 5000 km².
8. The design flood is taken as the maximum probable flood that may occur on a basin.
9. The unit storm is of such duration that the period of surface runoff is much less for any other storm of shorter duration.
10. The staff-gauge reading corresponding to zero-discharge in a stream is always a positive number.

II Write Short notes on ANY FIVE of the following (5x2=10)

1. What is meant by 'the water balance of a catchment'?
2. What are the methods of estimating runoff from a catchment?
3. Following velocities were recorded in a stream with a current meter.

Depth above bed (m)	0	1	2	3	4
Velocity (m/s)	0	0.5	0.7	0.8	0.8

Find the discharge per unit width of stream near the point of measurement. Depth of flow at the point was 5 m.

4. Rain-gauge station D was inoperative for part of a month during which a storm occurred. The storm rainfall recorded in the three surrounding stations A, B and C were 8.5, 6.7 and 9.0 cm, respectively. If the average annual rainfall for the stations are 75, 84, 70 and 90 cm, respectively, estimate the storm rainfall at station D.
5. What do you understand by drought? What are its causes and how it can be managed?
6. Define 'flood routing'. What are the usual assumptions made in routing a flood in a reservoir?
7. Describe with the help of neat sketches the methods of separation of base flow from the hydrograph.

III Answer ANY FIVE of the following (5x4=20)

1. (a) Define hydrograph. Draw a single-peaked hydrograph and indicate its various components.
(b) State the significance of the inflection point on the recession side of the hydrograph.
2. Describe the Muskingum method of routing an inflow hydrograph through a channel reach. Assume the values of the coefficients K and x for the reach are known.

3. Explain the procedure of deriving a synthetic unit hydrograph for a catchment by using Snyder's method.
4. A storm over a catchment of area 5 km^2 had duration of 14 hours. The mass curve of rainfall of the storm is as follows:

Time from start of storm (h)	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 index for the catchment is 0.4 cm/h , determine the effective rainfall hyetograph and the volume of direct runoff from the catchment due to the storm.

5. Explain the various commonly used methods of measurement of stage of a river. Indicate for each method its specific advantage and the conditions under which one would use it.
6. The ordinates of a 4-hour unit hydrograph for a particular basin are given below. Determine the ordinates of the S-curve hydrograph and therefrom the ordinates of the 6-hour unit hydrograph.

Time (h)	4-h UH (cumec)	Time (h)	4-h UH (cumec)
0	0	12	110
2	25	14	70
4	100	16	30
6	160	18	20
8	190	20	6
10	170	22	1.5
		24	0

7. The highest annual floods for a river for 60 years were statistically analyzed. The sixth largest flood was 30,000 cumec.

Determine:

- (a) The period in which the flood of 30,000 cumec may reoccur once
- (b) The percentage chance that this flood may occur in any one year
- (c) The percentage chance that this flood may not occur in the next 20 years
- (d) The percentage chance that this flood may occur once or more in the next 20 years
- (e) The percentage chance that a 50-yr flood may occur (a) once in 50 years, (b) one or more times in 50 years.

IV

Write an essay on ANY ONE of the following

(1x10=10)

1. The stream flows due to three successive storms of 2.9, 4.9 and 3.9 cm of 6 hours' duration each on a basin are given below. The area of the basin is 118.8 km^2 . Assuming a constant base flow of 20 cumec, derive a 6-hour unit hydrograph for the basin. An average storm loss of 0.15 cm/h can be assumed.

Time (h):	0	3	6	9	12	15	18	21	24	27	30	33
Flow (cumec):	20	50	92	140	199	202	204	144	84.5	45.5	29	20

2. (a) Explain the infiltration process and the resulting soil moisture zones in the soil. Also discuss the factors affecting the infiltration capacity of an area.
- (b) The infiltration capacity in a basin is represented by Horton's equation as $f_p = 3.0 + e^{-2t}$ where f_p is in cm/h and t is in hours. Assuming the infiltration to take place at capacity rates in a storm of 60 minutes duration, estimate the depth of infiltration in
 - (i) the first 30 minutes and
 - (ii) the second 30 minutes of the storm
