



**Bachelor of Biosystems Technology
Faculty of Technology
South Eastern University of Sri Lanka**

BSE 11022 – Hydrology and Meteorology

Assignment 4

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1. The mass curve of a storm is given below. Determine the effective rainfall and volume of direct runoff from the watershed due to given storm, if the area of watershed is 35 km². Assume the Φ -index of the watershed as 0.45 cm/h.

Time or start of storm (h)	0	3	6	9	12	15	18	21	24	27
Accumulated rainfall (cm)	0	0.75	3.50	4.75	7.15	9.20	9.90	10.50	11.75	13.0

2. Using the data in Question 1, compute the duration of effective rainfall.
3. Compute the effective rainfall due to following storm. Take the Φ -index for watershed as 0.35 cm/h.

Time since start of rainfall (h)	0	3	6	9	12
Accumulated rainfall (cm)	0	4	11	15	17

4. On a watershed of area 35 km², two storms of magnitude 2.5 and 2.0 cm occurring consecutively at 3.0 hour durations. The produced hydrograph at the outlet of watershed is given below. Determine the rainfall excess and Φ -index.

Time (h)	-3	0	3	6	9	12	15	18	21	24	27	30	33
Discharge (m ³ /s)	4.5	4.5	11.0	23.0	16.0	14.5	11.5	7.0	6.5	5.0	4.5	4.5	4.5

5. The followings are the ordinates of 3 hour unit hydrograph of a given watershed. Determine the ordinates of DRH due to ER of 3.0 cm.

Time (h)	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
OUHD (m ³ /s)	0	30	70	105	150	180	205	170	100	85	60	50	35	25	25	15

6. At the outlet of a given watershed the following hydrograph was produced by a storm of 4.2 cm. Compute the ordinates of DRH and total volume of surface runoff. Assume the constant base flow as $3.0 \text{ m}^3/\text{s}$.

Time (h)	0	3	6	9	12	15	18	21	24
Ordinate of hydrograph (m^3/s)	3.0	4.5	7.0	2.0	10.5	7.0	5.0	4.0	3.0

7. Compute the ordinates of DRH due to two successive storms of 3-h duration having their rainfall excess as 2.5 and 3.0 cm, respectively. The ordinates of unit hydrograph of 3-h duration are the same as given in question 5.
8. Compute the ordinates of hydrograph of 5 cm ER, from the given unit hydrograph in question 5. Consider the constant base flow as $10\text{m}^3/\text{s}$.
9. Derive the ordinates of 3-h unit hydrograph for a watershed. The measured discharge rates at the outlet of watershed are given below. The area of watershed is 500 sq km.

Time (h)	-3	0	3	6	9	12	15	18	21	24	27	30
Discharge (m^3/s)	10	10	10	37	50	75	115	110	101	79	65	61
Time (h)	33	36	39	42	45	48	51	54	57	60	63	66
Discharge (m^3/s)	57	50	47	45	40	33	30	25	17	15	10	10

10. Derive a 9-h unit hydrograph from the ordinates of 3-h unit hydrograph given in question 5
11. The following are the ordinates of the flood hydrograph from a catchment area of 780 km^2 due to 6 h storm. Derive the 6 h unit hydrograph of the basin.

Time (h)	6	12	18	24	6	12	18	24	6	12	18	24	6
Discharge (m^3/s)	40	64	215	360	405	350	270	205	145	100	70	50	40

12. The following data represent the ordinates of hourly interval of one unit hydrograph;

Time (h)	0	1	2	3	4	5	6	7	8	9	10	11	12	13
UH coordinates (m^3/s)	0	58	110	96	53	26	14	8	5	4	3	1.5	1	0

Compute storm hydrograph resulting from three-hour storm rainfall as;

Time (h)	1 st hr			2 nd hr			3 rd hr		
Rainfall depth (cm)	4			3			2.5		

Take Φ -index as 2 cm/hr and assume a base flow of $2 \text{ m}^3/\text{sec}$.

13. The flood data and base flow in a storm are estimated for a storm in a catchment area of 600 km^2 . Estimate the rainfall excess.

Time in days	0	1	2	3	4	5	6	7	8	9
Discharge (m^3/s)	20	63	151	133	90	63	44	29	20	20
Base flow (m^3/s)	20	22	25	28	28	26	23	21	20	20

