Birzeit University

Faculty of Engineering- Civil Engineering Department

HYDROLOGY AND HYDRAULICS – CE 435

(Midterm - Exam)

Instructor: Omar Zimmo, PhD. Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

No: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: 13 April 2021

Time: 10:00-11:30 ­­

***Question #1:* (30 points)**

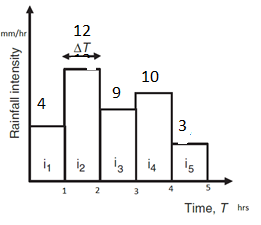
A catchment of area 1040 km2 is divided into 9-hourly divisions by isochrones (lines of equal travel time) in the figure. The catchment is divided into sub-areas such that all surface runoff from each of these areas will arrive during a 1-hr period at the gauging point. The hourly areas are as follows:

Hour 1 2 3 4 5 6 7 8 9

Area (km2) 40 100 150 180 160 155 140 80 35

For the effective storm event shown below:

1. Estimate the 5 hrs.-UH (in m3s-1) coming out of the catchment area.
2. Derive a 2 hrs.-UH.





***Question #2:* (20 points)**

The following table lists in order of magnitude the largest recorded discharge of a river with a drainage area of 12,560 km2.

|  |  |
| --- | --- |
| Year | Q (m3/s) |
| 1948 | 2604 |
| 1933 | 2105 |
| 1928 | 1842 |
| 1932 | 1842 |
| 1917 | 1797 |
| 1947 | 1780 |
| 1921 | 1774 |
| 1927 | 1743 |
| 1938 | 1596 |
| 1936 | 1590 |
| 1922 | 1567 |
| 1912 | 1553 |
| 1925 | 1494 |
| 1924 | 1468 |
| 1916 | 1386 |
| 1918 | 1295 |
| 1929 | 1292 |
| 1943 | 1278 |
| 1919 | 1273 |
| 1323 | 1205 |
| 1939 | 1114 |
| 1934 | 1100 |
| 1945 | 1057 |
| 1935 | 1046 |
| 1920 | 1035 |
| 1914 | 995 |
| 1931 | 955 |
| 1913 | 919 |
| 1940 | 851 |
| 1942 | 851 |
| 1946 | 837 |
| 1926 | 817 |
| 1937 | 771 |
| 1944 | 769 |
| 1930 | 678 |
| 1941 | 618 |
| 1915 | 599 |

1. Estimate the 40- and 75-year inflow.
2. What is the probability of the 100-year value occurring in any period of 7 consecutive year?

***Question #3:* (20 points)**

The inflow hydrograph readings for a stream reach are given below for which the Muskingum coefficients of K = 42 hr and x = 0.25 apply. Route the flood through the reach and determine the outflow hydrograph. Also determine the reduction in peak and the time of peak of outflow.

Outflow at the beginning of the flood may be taken as the same as inflow.

Time (hr) 0 8 16 24 32 40 48 56 64 72 80

Inflow (m3) 42 45 88 272 342 288 240 198 162 133 110

Time (hr) 88 96 104 112 120 128 136 144 152 160

Inflow (m3) 90 79 68 61 56 54 51 48 45 42



***Question #4:* (20 points)**

Analysis of rainfall and runoff records for a certain storm over a basin (of area 3210 km2) gave the following data:

Rainfall for successive 2 hr periods: 2.5, 6.5 and 4.5 cm/hr.

Direct surface discharge at the concentration point for successive 2-hr periods: 400, 1200, 4500, 7700, 12000, 10220, 8260, 3900, 838 and 400 m3.

Derive the unit hydrograph for the catchment area.

***Question #1:* (15 points)**

Calculate the evaporation for each month and the average yearly evaporation for Ramallah given the following data:

