

CE 3354 Engineering Hydrology
Exam 1

1. For a watershed with a size of 120 km^2 , the following data on precipitation P , evaporation E and runoff Q are recorded in watershed mm.

Table 1: Monthly Precipitation (P), Evapotranspiration (E), and Runoff (Q)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
P (mm)	250	205	165	50	5	0	0	5	10	55	65	190
E (mm)	5	25	30	50	80	100	150	70	60	20	10	5
Q (mm)	150	110	80	5	0	0	0	0	0	10	15	120

Determine:

- a) The month (end) when the amount of water stored in the basin is the largest.
- b) The month (end) when the amount of water stored in the basin is the smallest.
- c) The difference (in m^3) in the amount of water stored in the basin between these two extremes.
- d) The likely climate type (arid, humid temperate or humid tropical) one would expect to find this catchment.

2. A watershed with a catchment area of $1mi^2$ converts about 60-percent of precipitation into streamflow, the remainder is lost. The watershed response equation is

$$k \frac{dQ}{dt} + Q(t) = P(t) \cdot A \cdot C \quad (1)$$

where $Q(t)$ is the streamflow leaving the catchment, $P(t)$ is the precipitation entering the catchment, A is the catchment area, C is the precipitation to streamflow conversion fraction, and k is the basin characteristic time constant.

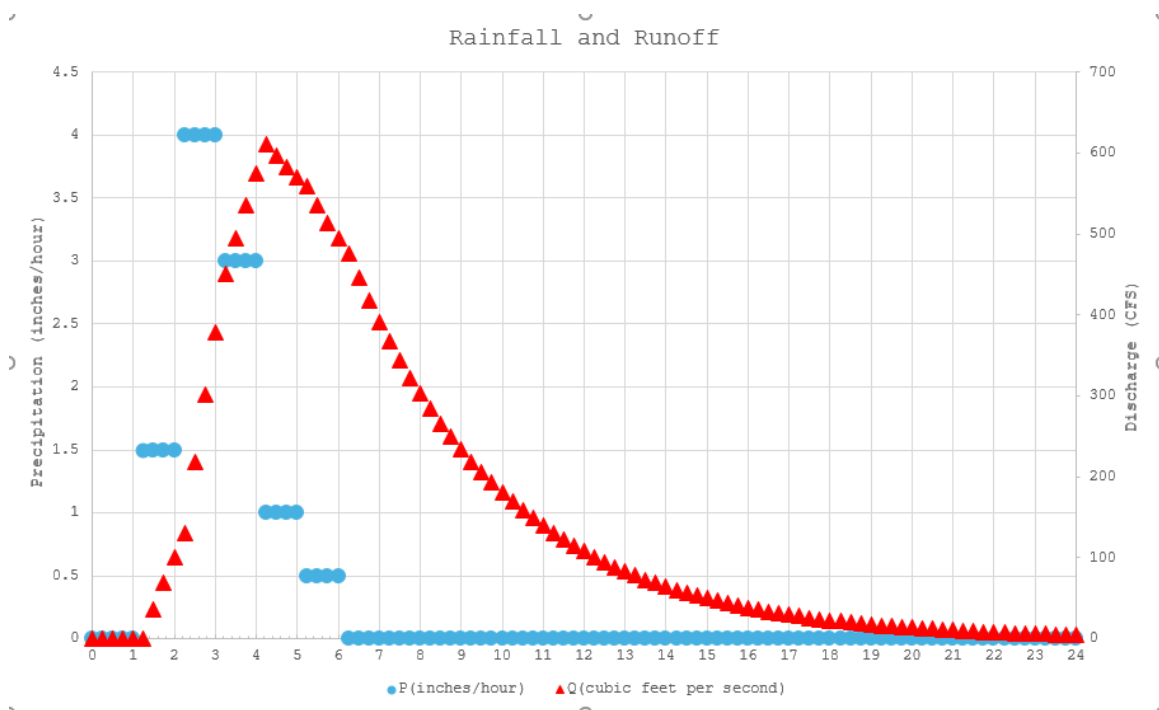


Figure 1: Rainfall-runoff plot for the catchment

Using the information in Figure 1 determine:

- The maximum discharge rate in cubic feet per second.
- The time when the maximum discharge occurs.
- The value in hours of the of the basin time constant k .
- The total volume in acre feet of precipitation entering the catchment (before any losses)
- The total volume in acre feet of discharge leaving the catchment

3. design storm

4. The relation between infiltration capacity in mm/hour and the time (in hours) since the start of the experiment as measured with an infiltrometer is depicted in Figure 2.

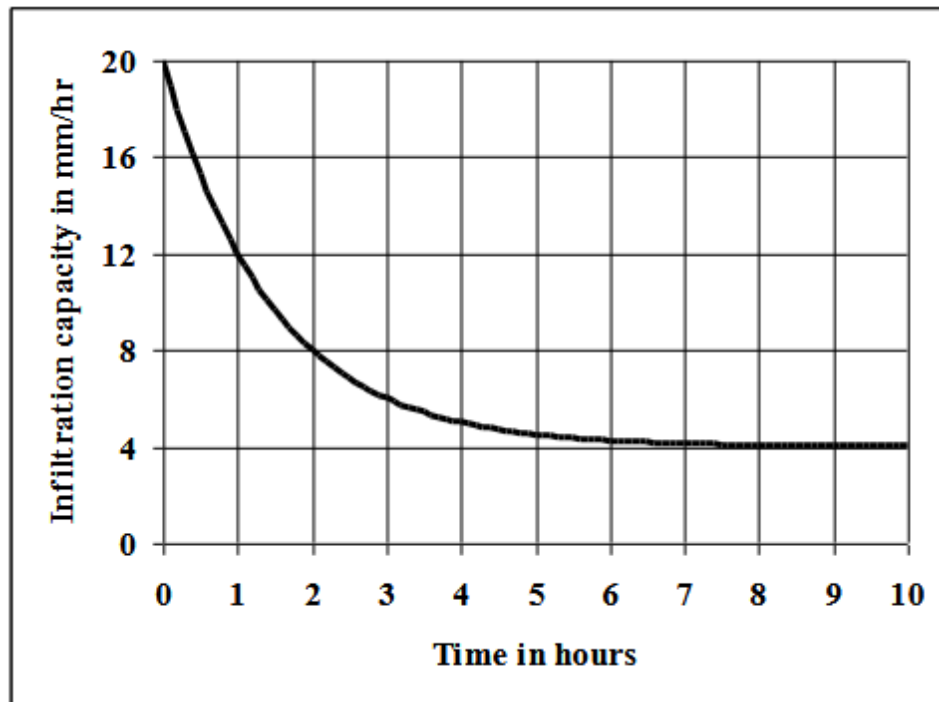


Figure 2: Infiltrometer data for some soil

The relationship is to be described with the Horton infiltration model

$$q(t) = f_c + (f_o - f_c)e^{-kt} \quad (2)$$

Determine:

- The equilibrium infiltration rate, f_c , in mm/hr.
- The initial (dry soil) infiltration rate, f_o , in mm/hr.
- The soil constant k .
- The total amount of water that will infiltrate into an initially dry soil during a rainstorm with a duration 60 minutes and a constant intensity of 20 mm/h.
- The total amount of water that will infiltrate into an initially dry soil during a rainstorm with a duration 480 minutes and a constant intensity of 12 mm/h.