Q2 Problem Statement,

rate of transfer of chemicals through each pipe is equal to flow rate. Delop mass balance equation for each reactor and solve the three linear algebric equation

given, $Q_{33} = 120$

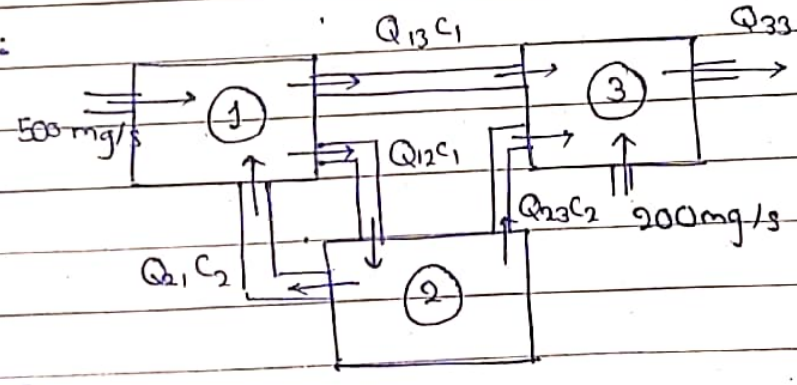
$Q_{13} = 40$

$Q_{12} = 90$

$Q_{23} = 60$

$Q_{21} = 30$

fig :



for (1)

$-Q_{13}C_1 + Q_{12}C_1 + 500 + Q_{21}C_2 = 0$

$500 = 40c_1 + 90c_1 - 30c_2$

$130c_1 - 30c_2 + 0c_3 = 500$

for (II)

$Q_{12}C_1 - Q_{21}C_2 - Q_{23}C_2 = 0$

$90c_1 - 30c_2 - 60c_2 = 0$

$90c_1 - 90c_2 + 0c_3 = 0$

for (III)

$$200 + Q_{13}c_1 + Q_{23}c_2 - Q_{33}c_3 = 0$$

$$200 = 120c_3 - 40c_1 - 60c_2$$

$$-40c_1 - 60c_2 + 120c_3 = 200$$

$$\Rightarrow \begin{bmatrix} 130 & -30 & 0 \\ 90 & -90 & 0 \\ -40 & -60 & +120 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} = \begin{bmatrix} 500 \\ 0 \\ 200 \end{bmatrix}$$

$$c_1 = \frac{1}{130}(500 + 30c_2) \qquad c_1 = \frac{1}{13}(50 + c_2)$$

$$c_2 = \frac{1(90c_1)}{90} \qquad c_2 = c_1$$

$$c_3 = \frac{1}{120}(200 + 40c_1 + 60c_2) \qquad c_3 = \frac{1}{12}(20 + 4c_1 + 6c_2)$$

iteration initial $x_1^0 = 0 \quad x_2^0 = 0 \quad x_3^0 = 0$

$$x_1^1 = \frac{50}{13} \qquad x_2^1 = x_1^1 = \frac{50}{13} \qquad x_3^1 = \frac{1}{12}\left(20 + 4\left(\frac{50}{13}\right) + 6\left(\frac{50}{13}\right)\right)$$

II iteration

$$c_1^2 = \frac{1}{13}(50 + c_2^1)$$

$$c_2^2 = c_1^2$$

$$c_3^2 = \frac{1}{12}(20 + 4c_1^2 + 6c_2^2)$$

$c_1 \quad c_2 \quad c_3 \Rightarrow 5.0 \quad 5.0 \quad 5.833333$

$c_1 \quad c_2 \quad c_3 \approx 5 \quad 5 \quad 6$