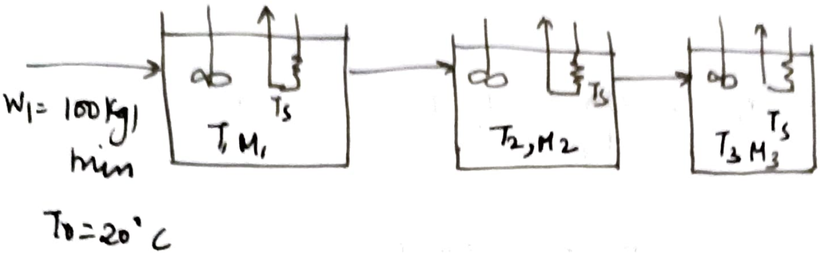

Initial value of T_1, T_2, T_3 in tank

$T_1 = 50^\circ C$, $T_2 = 50^\circ C$ $T_3 = 50^\circ C$

given,

$UA = 10$ kJ/min°C

$C_p = 2$ kJ/kg°C

$W = 100$ kg/min

$T_s = 250^\circ C$

Mass present inside the tank is constant

$M_1 = M_2 = M_3 = M$

From Energy Balance,

$$\frac{d}{dt}(MC_pT_1) = WC_p(T_0 - T_1) + UA(T_s - T_1)$$

$$\frac{d}{dt}(MC_pT_2) = WC_p(T_1 - T_2) + UA(T_s - T_2)$$

$$\frac{d}{dt}(MC_pT_3) = WC_p(T_2 - T_3) + UA(T_s - T_3)$$

(a) The dynamic Model Equations are :-

$$\frac{dT_1}{dt} = \frac{W}{M}(T_0 - T_1) + \frac{UA}{MC_p}(T_s - T_1) \quad \text{--- (1)}$$

$$\frac{dT_2}{dt} = \frac{W}{M}(T_1 - T_2) + \frac{UA}{MC_p}(T_s - T_2) \quad \text{--- (2)}$$

$$\frac{dT_3}{dt} = \frac{W}{M}(T_2 - T_3) + \frac{UA}{MC_p}(T_s - T_3) \quad \text{--- (3)}$$

(b) At steady state $\frac{d}{dt} \rightarrow 0$

$$\frac{dT_1}{dt} = \frac{dT_2}{dt} = \frac{dT_3}{dt} = 0$$

f_1: $W C_p (T_0 - T_1) + UA (T_s - T_1) = 0$

f_2: $W C_p (T_1 - T_2) + UA (T_s - T_2) = 0$

f_3: $W C_p (T_2 - T_3) + UA (T_s - T_3) = 0$

Solving the above eq^ns using fsolve in MATLAB.