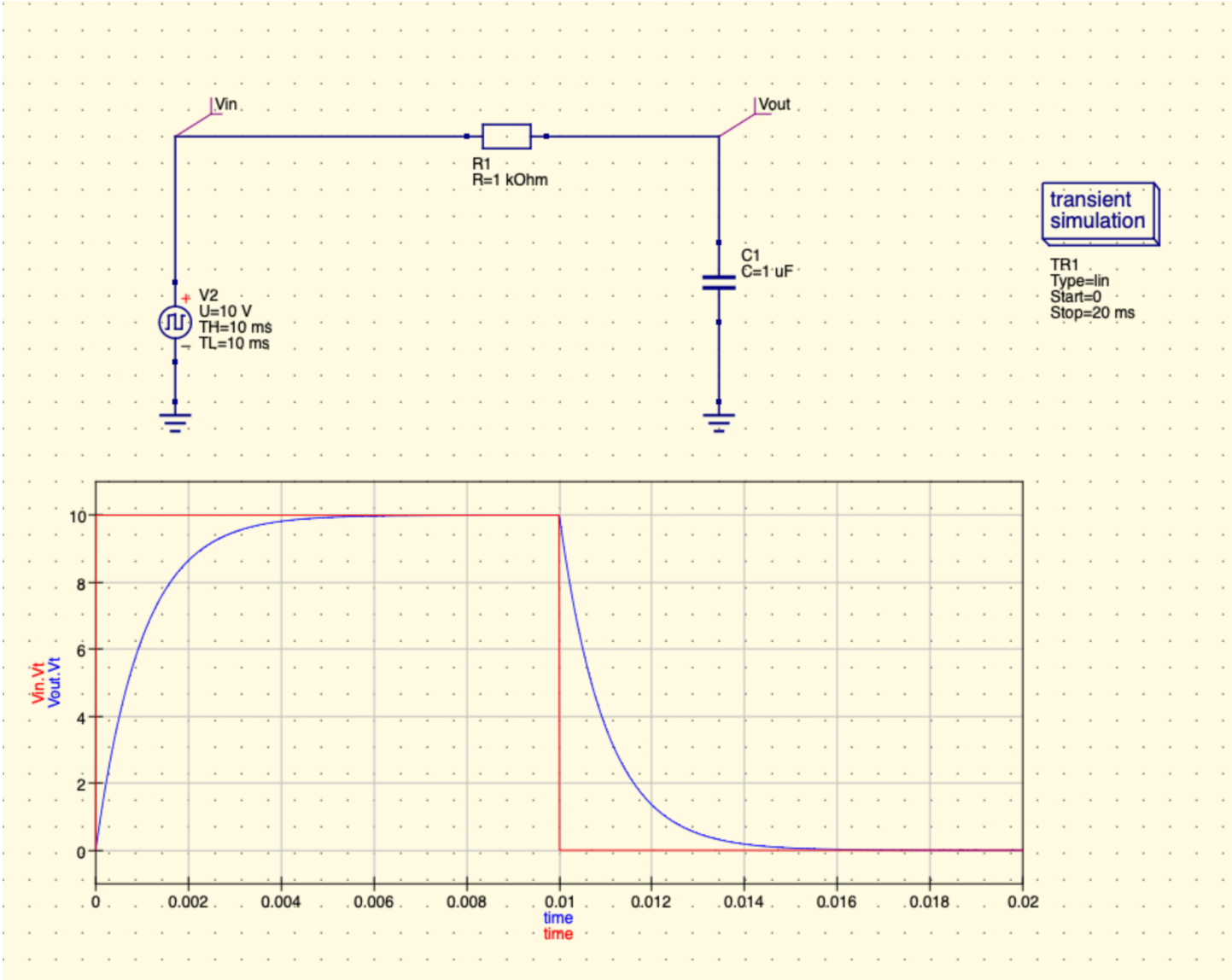
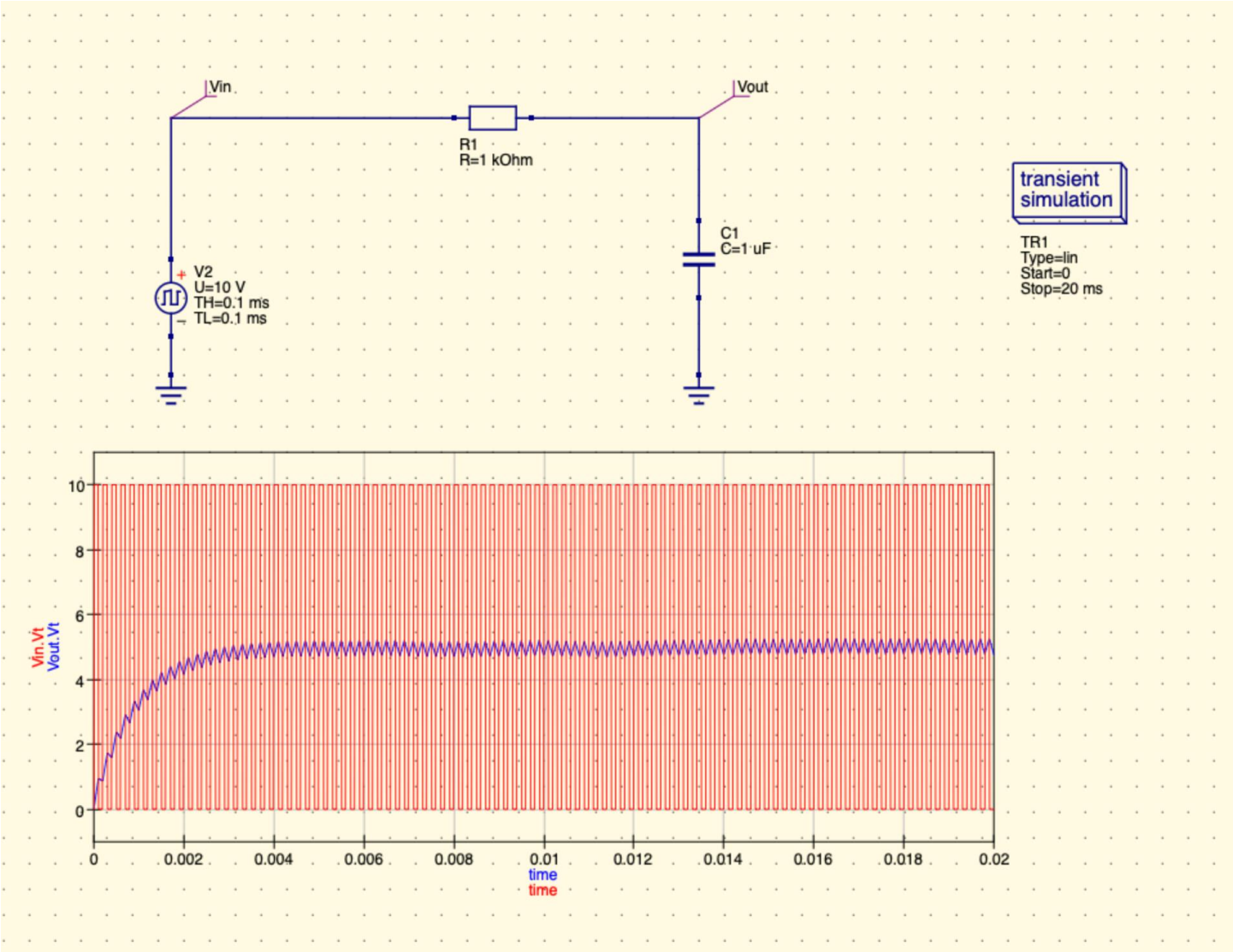
QUESTION 1

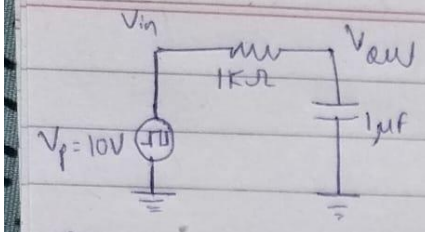


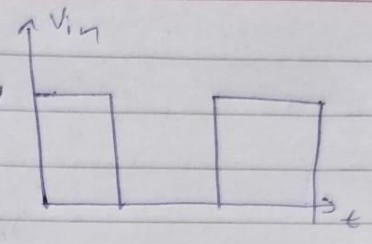
<u>Function of the circuit:</u> This circuit acts as a voltage follower as Vin = Vout for pulse frequency greater than or equal to 10 times the Time Constant (1ms)



<u>Function of the circuit</u>: This circuit acts as an integrator for pulse frequency lesser than the Time Constant (1ms).

<u>PROOF</u>:





(a) ∵ $\tau \ll T$, where $\tau = 1ms$

∴ for the half cycle :-

∴ $V_{out} = 10(1 - e^{-t/\tau})$

$V_{out} \simeq 10V$

for -ve half cycle

$V_{out} = 10\, e^{-t/\tau}$

$V_{out} = 0V$

(b) for $T \ll \tau$

1st half cycle :-

$V_c = 10\left(1 - e^{-t/2RC}\right)$

$V_c = \left[10\left(1 - e^{-t/2RC}\right)\right] e^{-t/2RC}$ (1st cycle)

V_c = 1st half cycle + 1st cycle

$= \left[10\left(1 - e^{-t/2RC}\right)\right] e^{-t/2RC} + 10\left(1 - e^{-t/2RC}\right)$

(for 1.5 cycle)

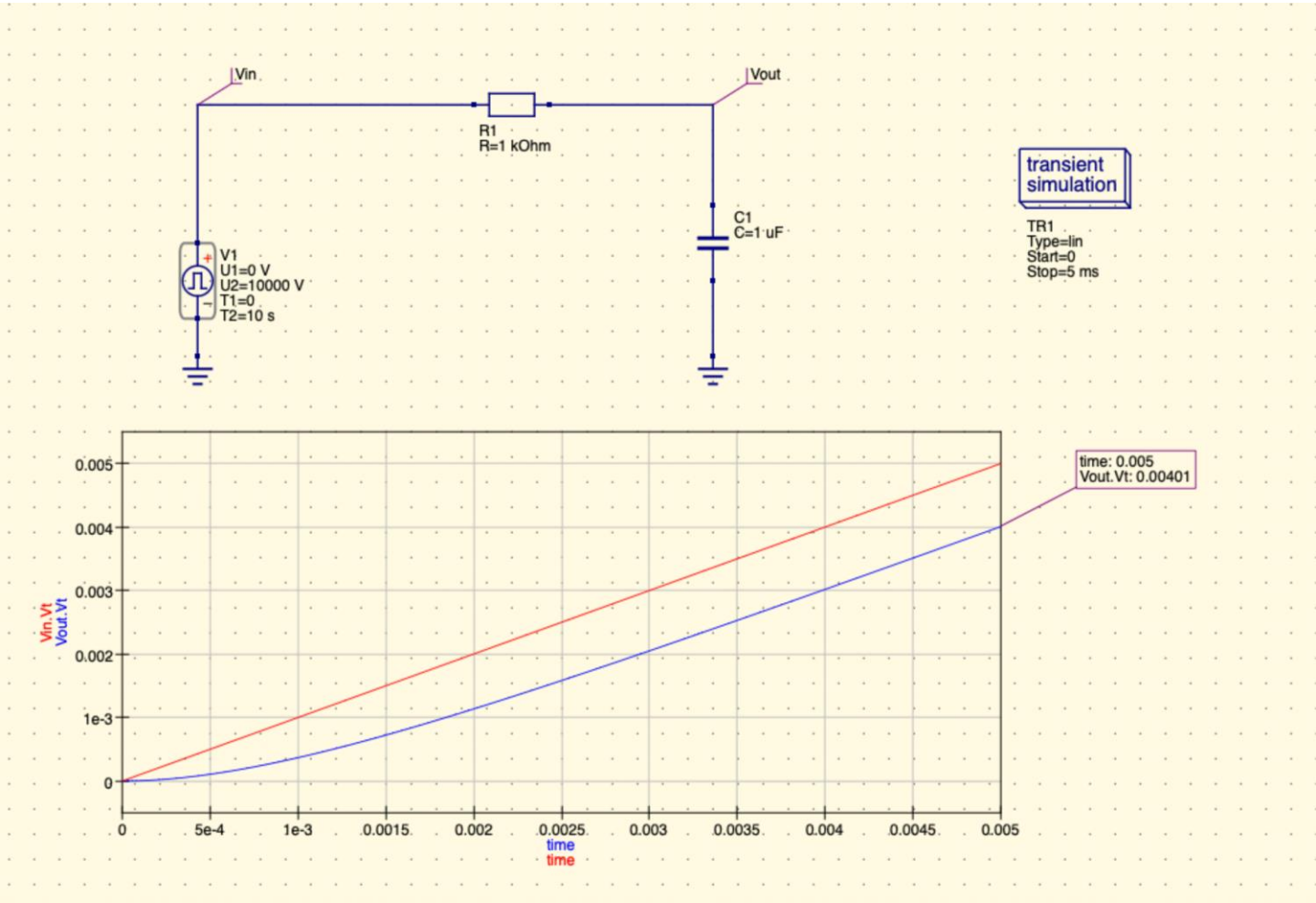
let $e^{-t/2RC} = x$

$V_c = 10(1 - x + x^2 - x^3 \cdots)$ (for ∞ cycles)

$V_c = \frac{10(1)}{1+x} = \frac{10}{1 + e^{-t/2RC}}$

$\therefore V_c = \frac{10}{1+1} = 5V$ $(t \ll 2RC)$

QUESTION 2:



What happens in the circuit:

The capacitor delays (offsets) the input ramp voltage by 1mV.

Expected Output at Vout node:

Vout(t) = Vin(t) -Vin(T), where T = Time Constant = 1ms

At t = 5ms, t>>T:

Vout(5ms) = Vin(5ms) - 1mV = 5mV – 1mV = 4mV

Simulation Output at Vout: Vout(5ms) = 4mV