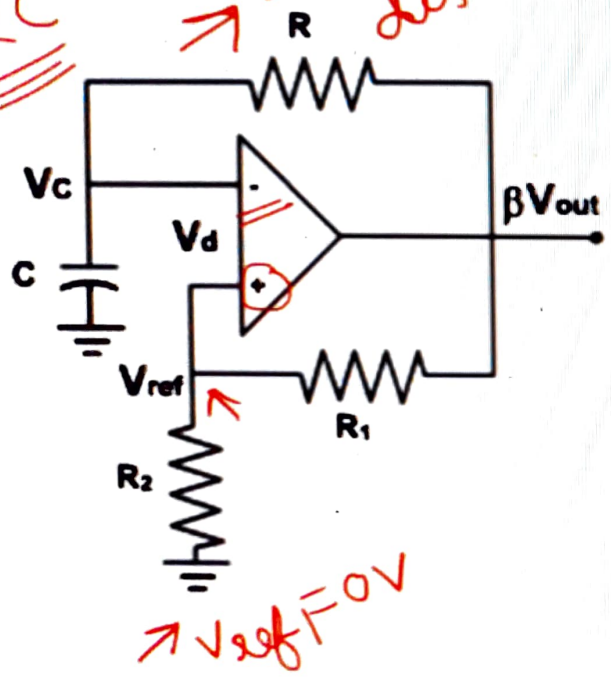
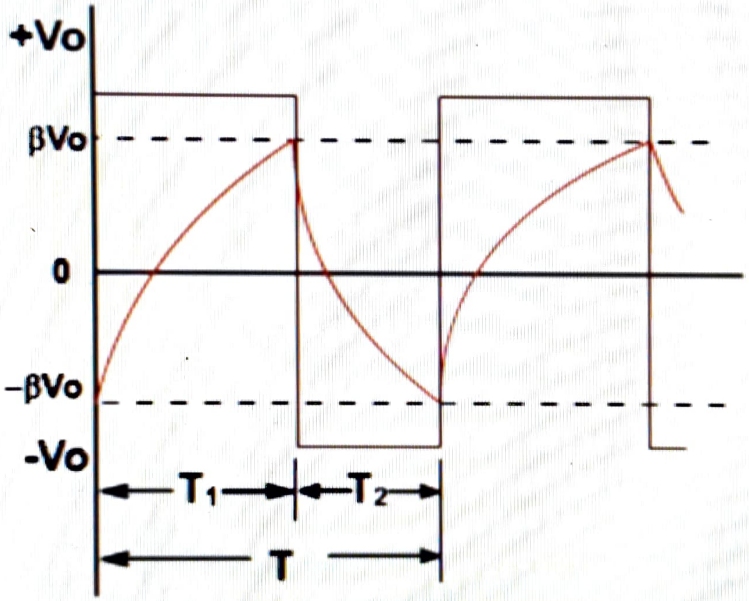
Square wave generator (Astable multivibrator)

energy storage element
store
discharge
RC



Vref = 0V



$$\beta = \frac{R_2}{R_1 + R_2}$$

$$V_{ref} = \frac{R_2}{R_1 + R_2} V_{sat}$$

$$= \beta V_{sat}$$

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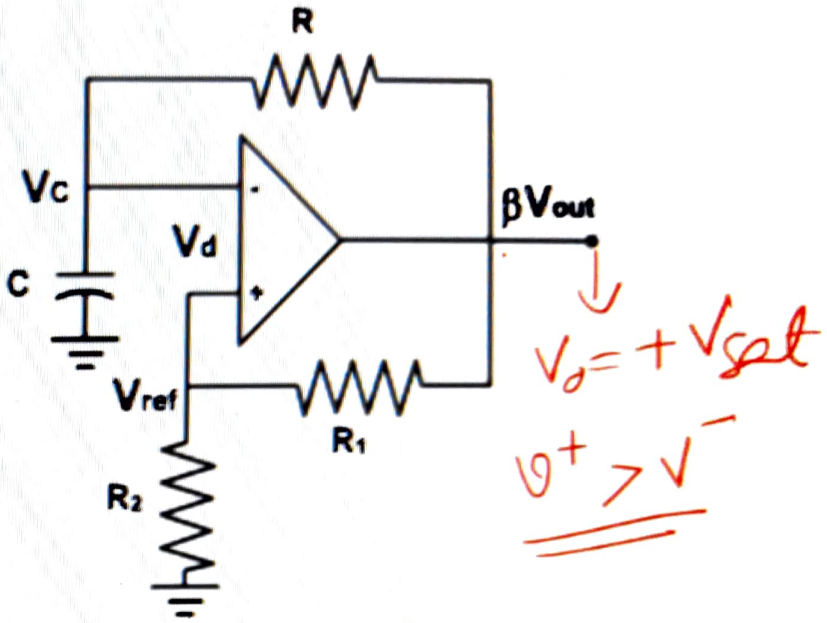


- Let, $v_o = +V_{sat}$

Voltage across the capacitor

$$v_c(t) = V_f + (V_i - V_f)e^{-t/RC}$$

Final value, $V_f = +V_{Sat}$

Initial value, $V_i = -\beta V_{Sat}$

$$\therefore v_c(t) = V_{Sat} - V_{Sat}(1+\beta)e^{-t/RC}$$

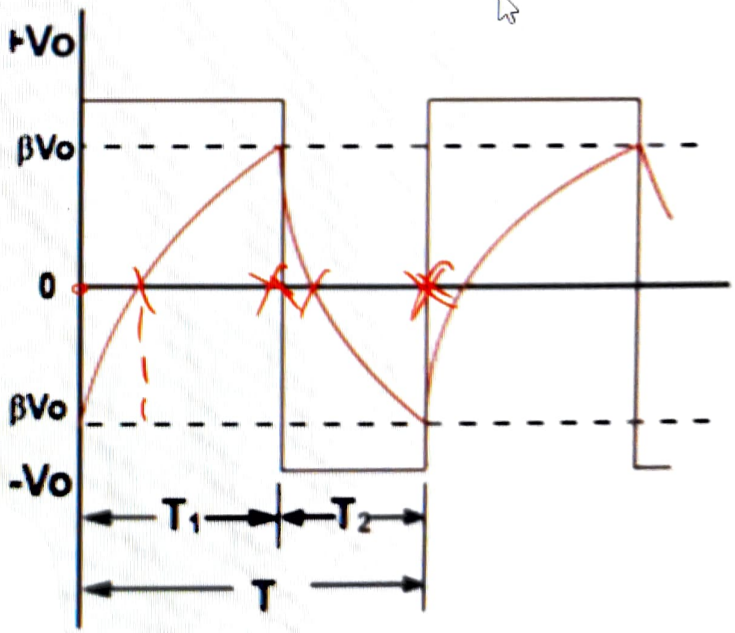
At $t = T_1$

$$v_c(T_1) = \beta V_{sat}$$

$$\beta V_{sat} = V_{Sat} - V_{Sat}(1+\beta)e^{-T_1/RC}$$

Solving

$$T_1 = RC\ln\left(\frac{1+\beta}{1-\beta}\right)$$



Design of square wave generator

Let the frequency of oscillation be 1 kHz

Take $\beta = 0.5$ and $R_1 = R_2 = 10\ \text{k}\Omega$.

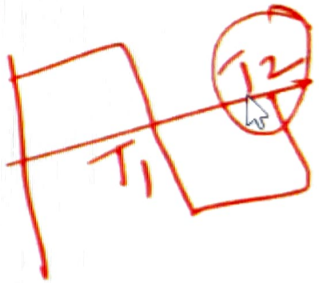
Frequency, $f = \dfrac{1}{2RC \ln 3}$ Assume $C = 0.1\ \mu\text{F}$

Then, $R = \dfrac{1}{2Cf \ln 3} = \dfrac{1}{2 \times 0.1 \times 10^{-6} \times 1000 \times \ln 3} = 4.55\ \text{k}\Omega$

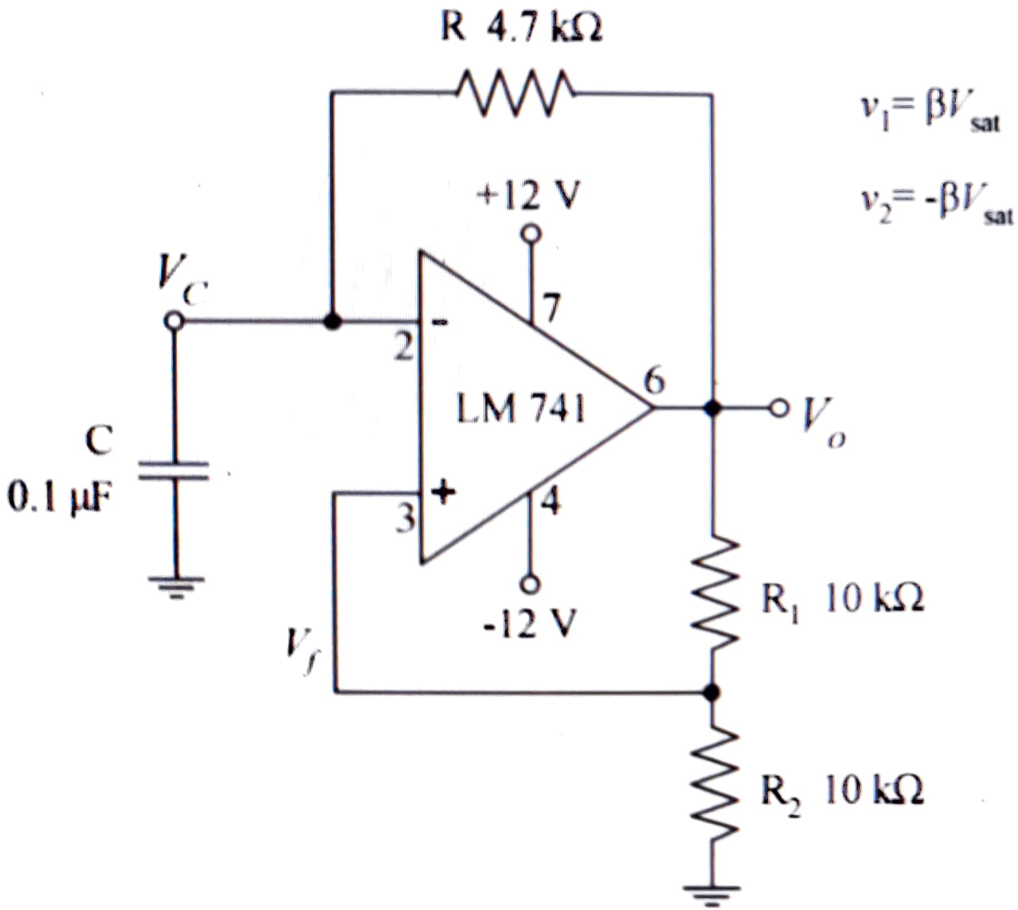
Select standard value of 4.7 kΩ for R.

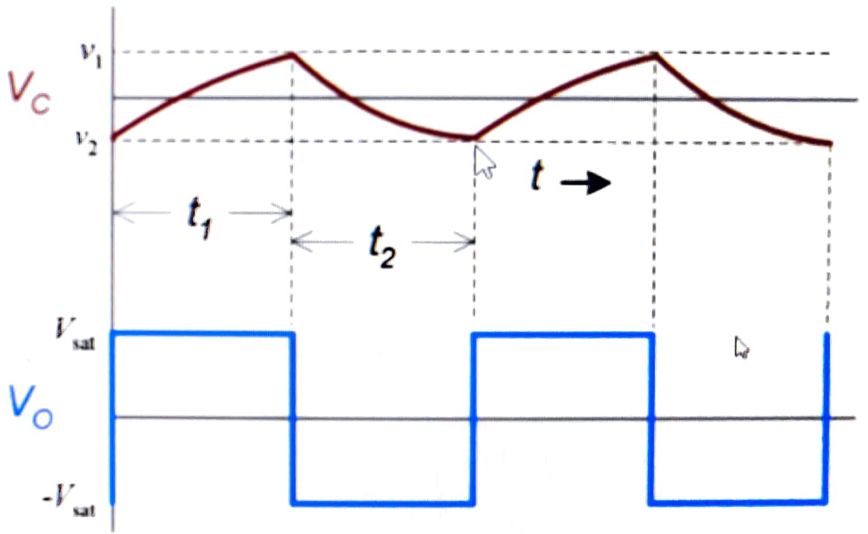
Square wave generator (Astable multivibrator)

- If $R_1 = R_2 = R$
  - Expression for period = $T_1 = 2RC\ln\left(\frac{2+R}{2-R}\right)$
  - The frequency of oscillation =



Square wave generator





Triangular waveform generator