Linear Integrated Circuits

LAB TASK-3

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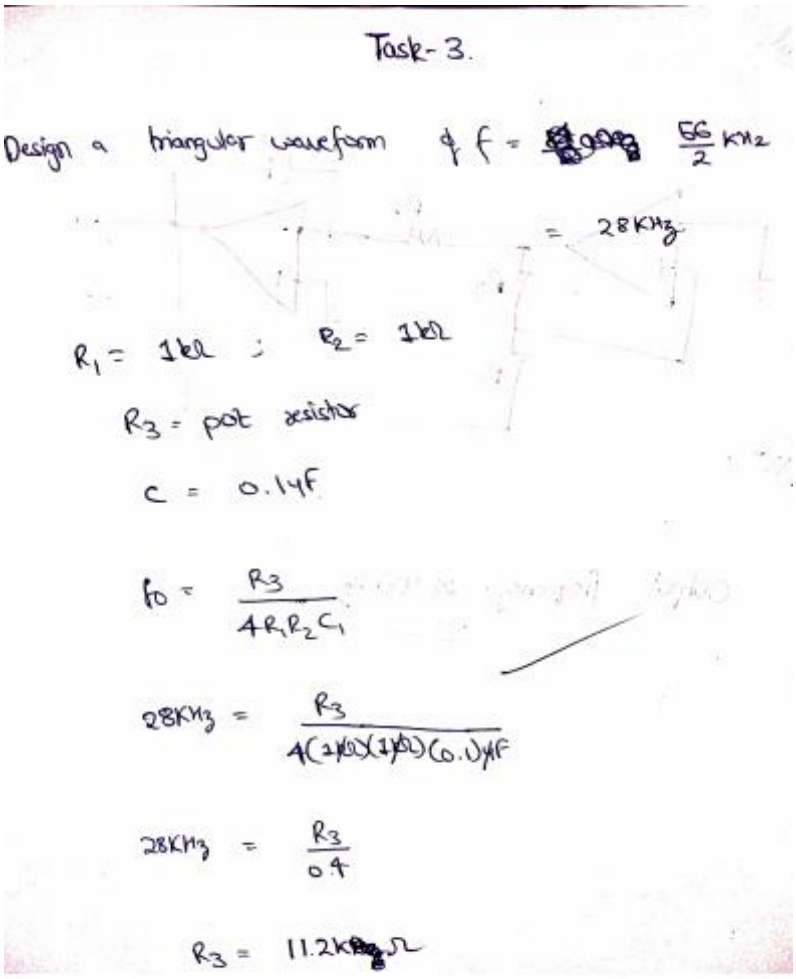
Slot: G1

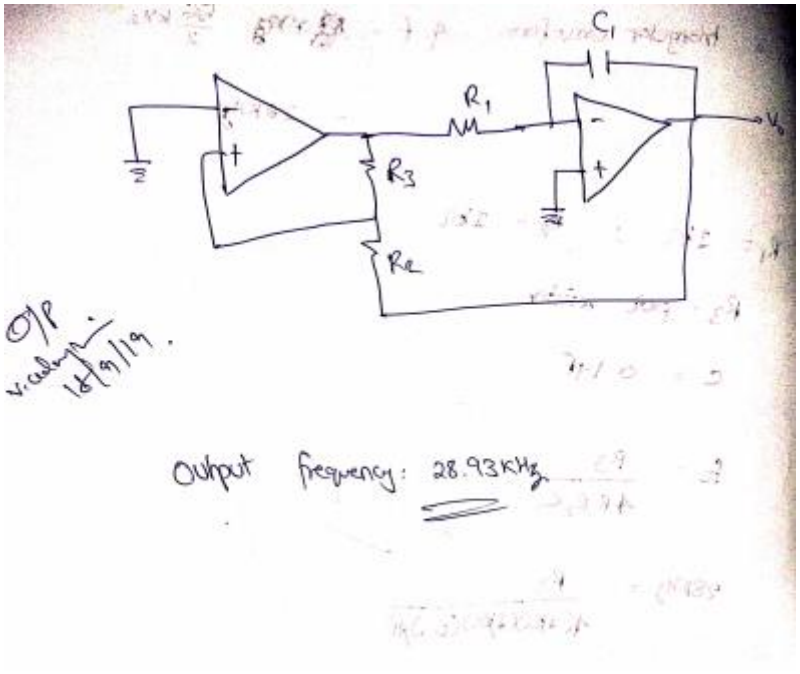
Aim:

To design a triangular waveform generator using OPAMP IC741

Steps to be followe:

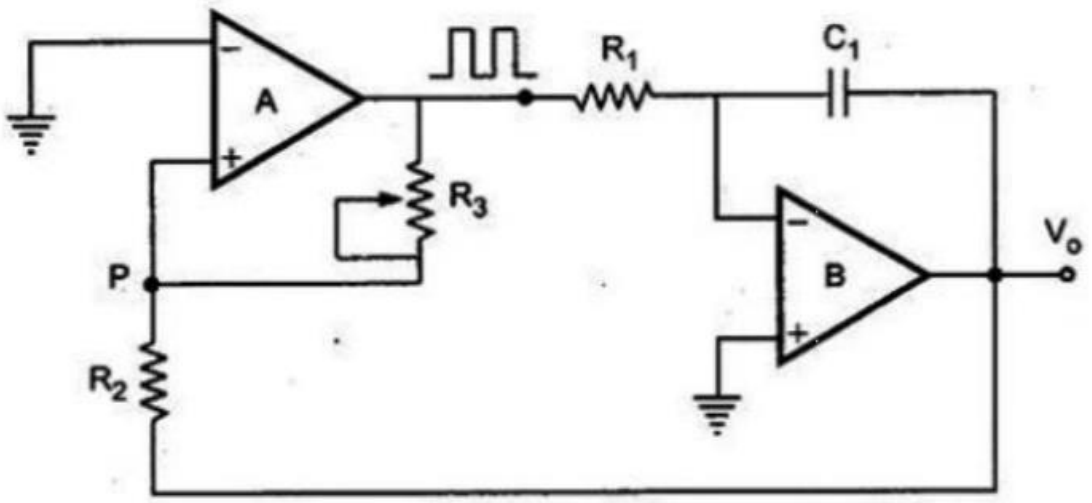
1) **Finding output frequency from registration number and R3 calculations:**





2) Output frequency calculated: 28Khz

3) Derivation of period T for triangular wave generator:



When Comparator output is at $+V_{sat}$, Voltage at P is

$$-V_{ramp} + \frac{R_2}{R_2+R_3}\left[+V_{sat} - (-V_{ramp})\right] = 0$$

$$\frac{-R_3}{R_2+R_3}(V_{ramp}) = \frac{-R_2}{R_2+R_3}(+V_{sat})$$

$$-V_{ramp} = \frac{-R_2}{R_3}(+V_{sat})$$

Similarly for $-V_{sat}$; $V_{ramp} = \frac{-R_2}{R_3}(-V_{sat})$

$$V_{o(PP)} = -\frac{1}{R_1C_1}\int_0^{T/2}(-V_{sat})\,dt = \left(\frac{V_{sat}}{R_1C_1}\right)\frac{T}{2}$$

$$T = \frac{2R_1C_1V_{o(PP)}}{V_{sat}} \rightarrow (1)$$

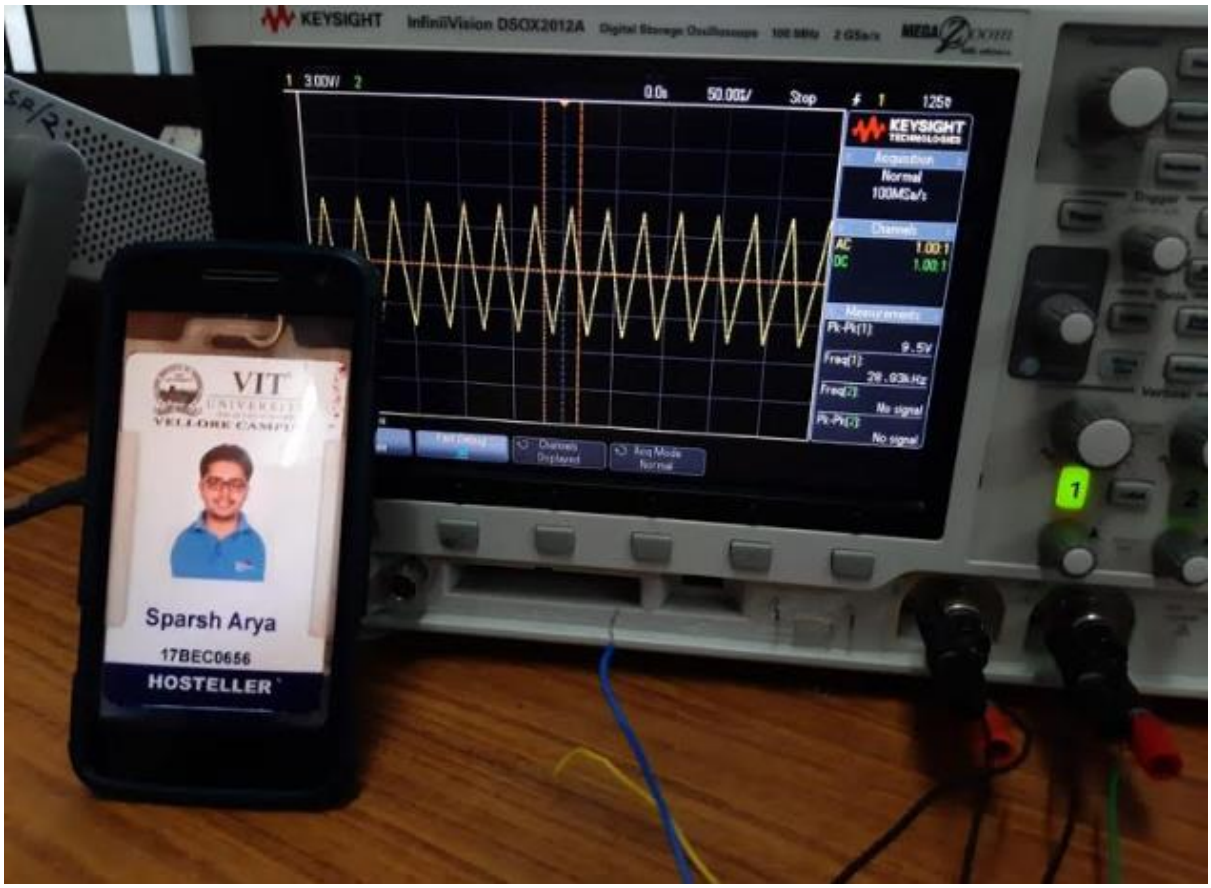
$$V_{o(PP)} = +V_{ramp} - (-V_{ramp})$$

if $|+V_{sat}| = |-V_{sat}|$, $V_{o(PP)} = \frac{2R_2}{R_3}V_{sat} \rightarrow (2)$

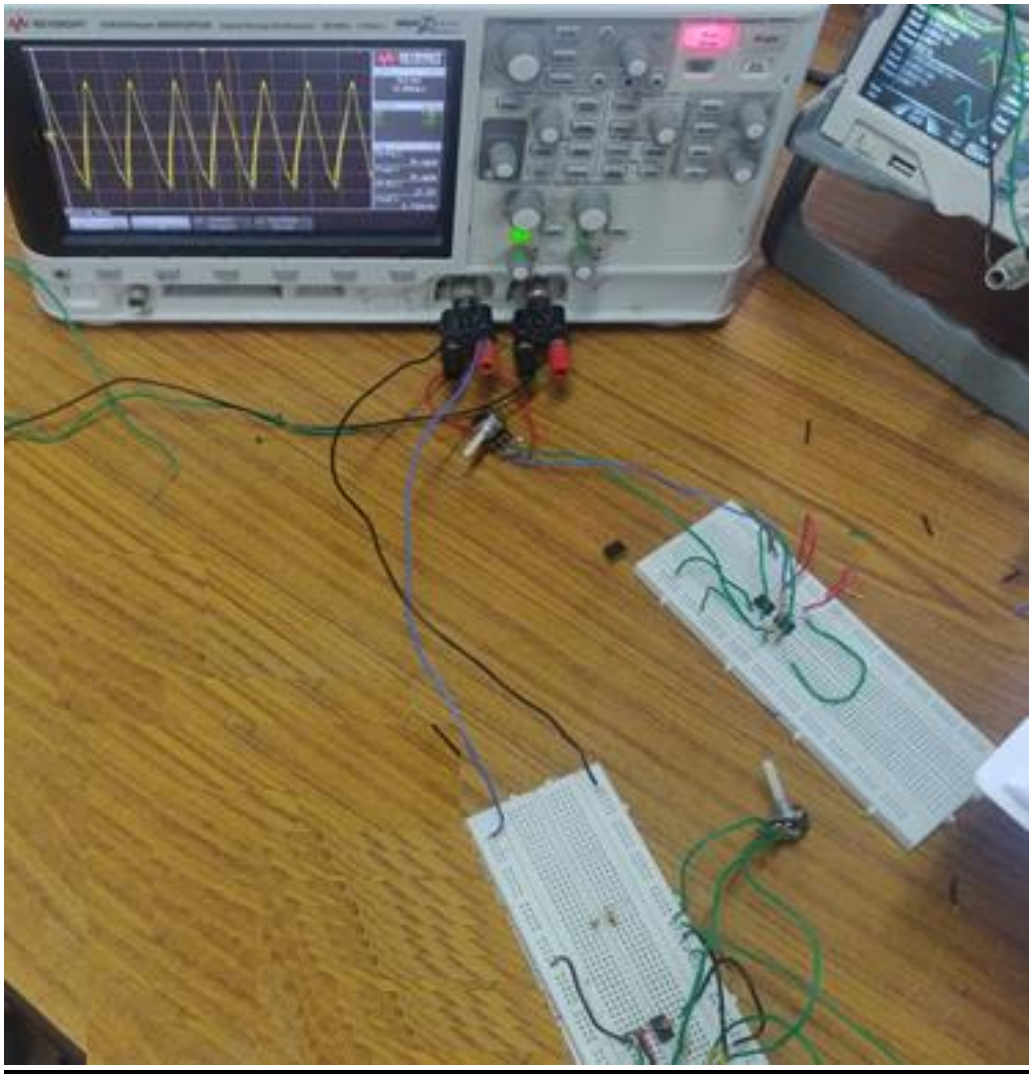
Substituting (2) in (1)

$$T = \frac{2R_1C_1\left(\frac{2R_2}{R_3}\cdot V_{sat}\right)}{V_{sat}} = \frac{4R_1C_1R_2}{R_3}$$

4) Output waveform:



Circuital connections



5) experimental value of period and comparison with theoretical period:

f_{exp}=28.93KHz

$T_{exp}=1/2\pi f_{exp}$

=55.01µs

$f_{theoretical}$=28KHz

$T_{theoretical}=1/2\pi f_{theoretical}$

=56.84µs

6) Impact of R3 on frequency:

By replacing R3 or R2 with a potentiometer resistance we could adjust the feedback fraction, β and therefore the reference voltage value at the non-inverting input to cause the op-amp to change state anywhere from zero to 90^o of each half cycle so long as the reference voltage, Vref remained below the maximum amplitude of the input signal ,the frequency changes.

7) Result

Thus, the waveforms have been plotted and the output has been verified.