06/05/2020. BEC - ASSIGNMENT - 3

C3 :

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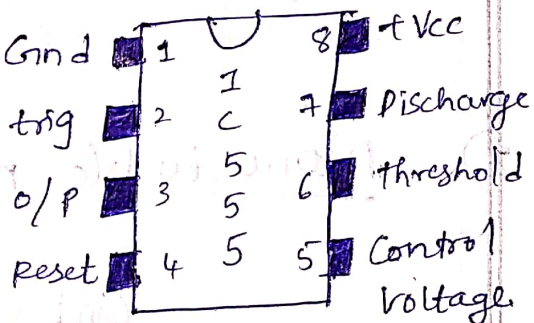
Q1) Astable Multivibrator using 555 timer :-

The 555-timer IC can be used with a few simple components to build an astable circuit which provides a 'square wave'. This is a digital wave, formed with sharp transistors between low (0V) and high (+V). the durations of the low and high states may be different. the circuit is called astable because it is not stable in any state

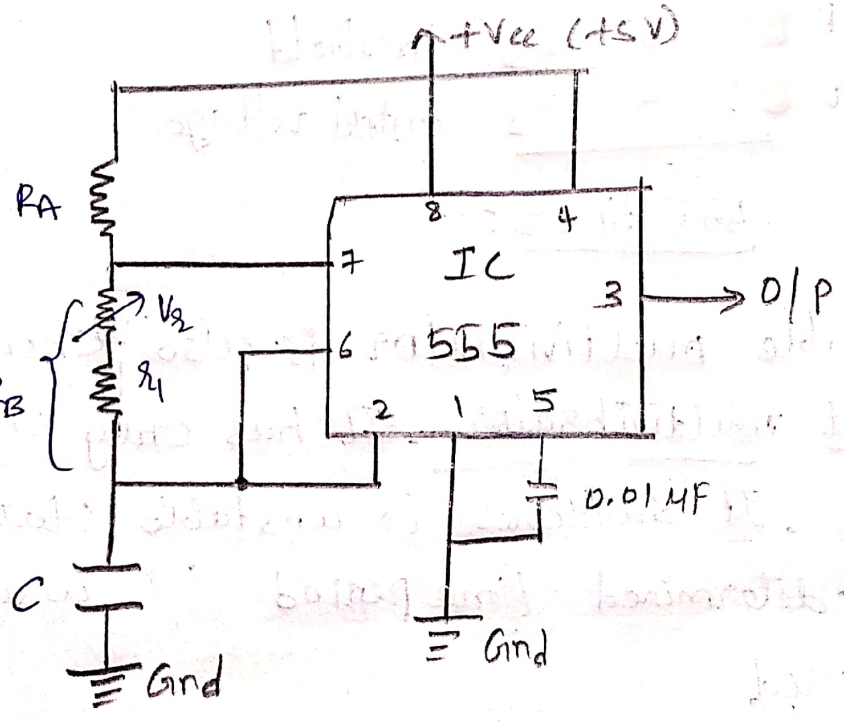
→ the output is continuously changing between 'low' and 'high'.

555-timer



Astable multivibrator :

$$R_B = R + VR_1$$



Expression for time period :

$$T = t_c + t_d$$

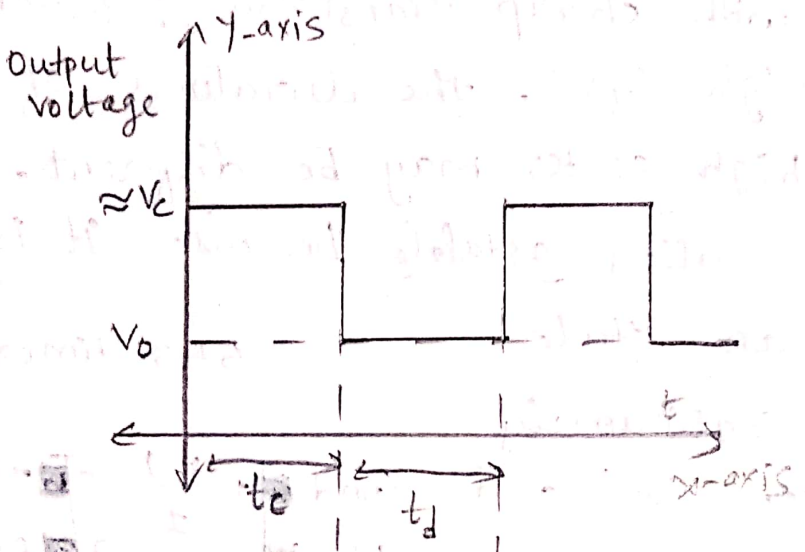
$$\begin{cases} t_c = 0.69 (R_A + R_B) C \\ t_d = 0.69 (R_B C) \end{cases}$$

$$\boxed{T = 0.69 (R_A + 2R_B) C}$$

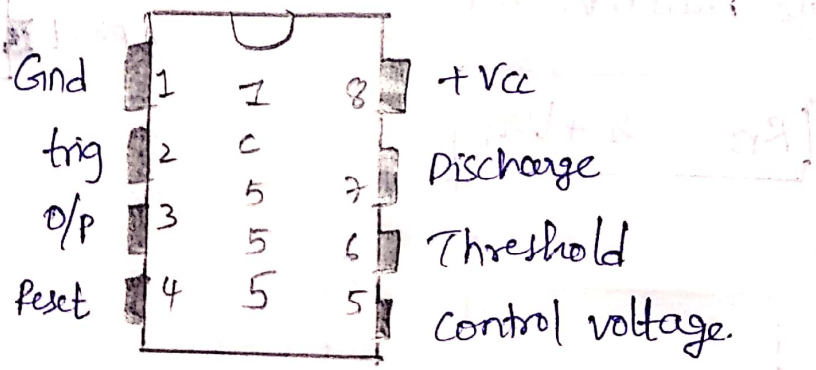
Frequency :

$$f = \frac{1}{T}$$

$$f = \frac{1}{0.69 (R_A + 2R_B) C}$$



2) Monostable multivibrator using 555 timer :



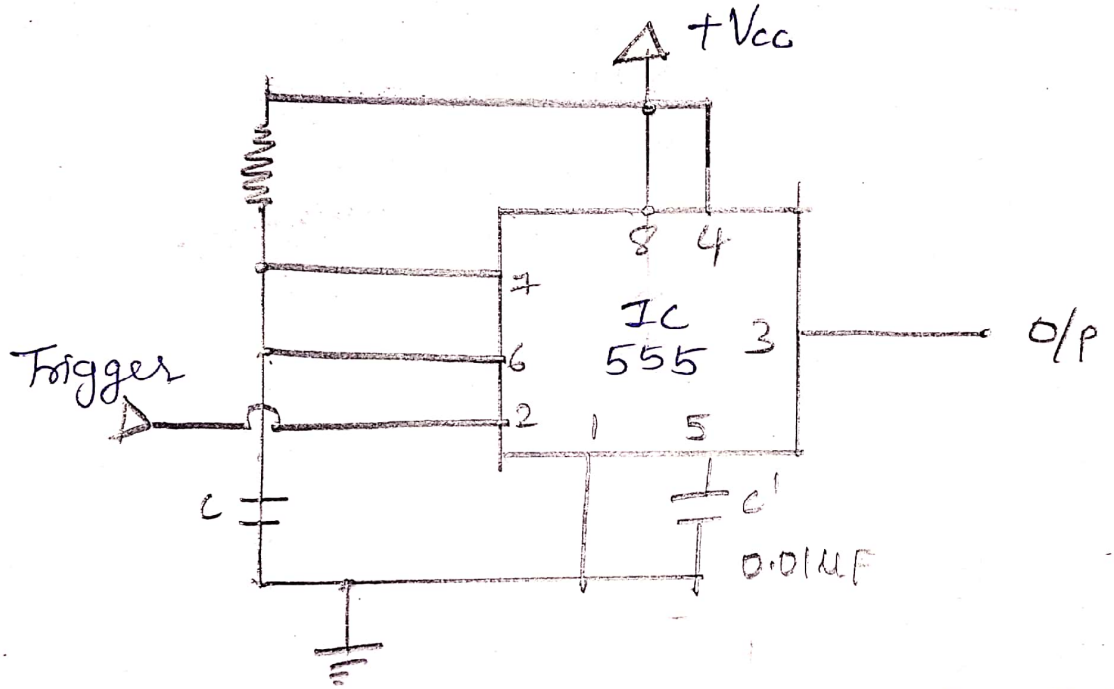
555 timer :

Monostable multivibrator is also known as One short multivibrator. It has only one stable state. It switches to unstable state for a predetermined time period 'T' when it is triggered.

⇒ The time period 'T' is determined by RC time constant in the circuit.

⇒ Monostable state or mode of 555 timer is commonly used for generating pulse width modulation (PWM) waves.

Monostable multivibrator :-



We know that the voltage across the capacitor 'C' rises exponentially. Hence, the equation for the capacitor voltage V_c can be written as

$$V_c = V_{CC}(1 - e^{-t/RC})$$

[When capacitor voltage is $\frac{1}{3} V_{cc}$

$$\frac{1}{3} V_{cc} = V_{cc}(1 - e^{-t/RC})$$

$$e^{-t/RC} = 1/3$$

$$-\frac{t}{RC} = \ln(1/3)$$

$$-t/RC = -1.098$$

$$t = 1.098RC$$

$$t \cong 1.1RC$$