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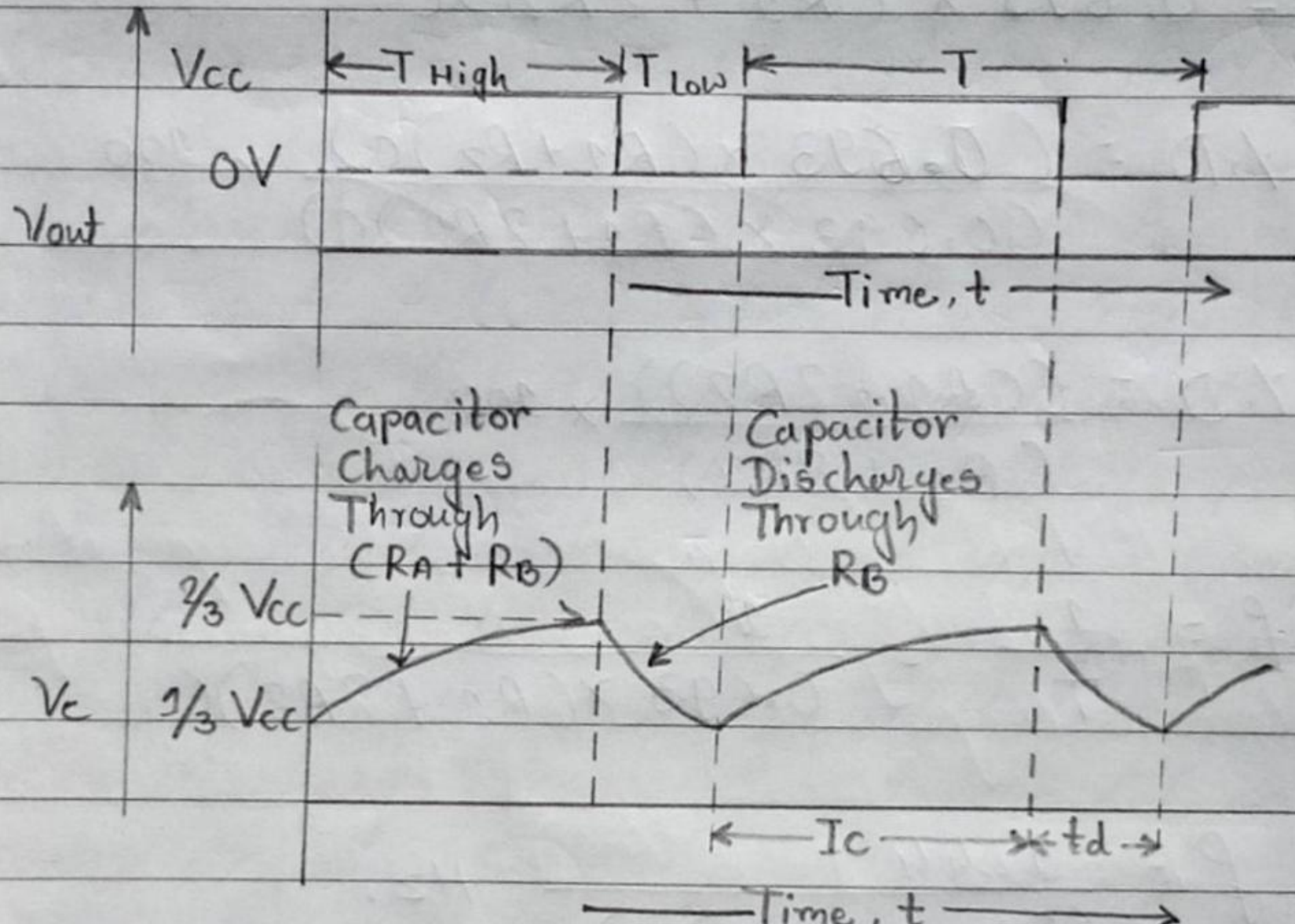
Q ② Explain working of IC555 as an Astable Multivibrator with the help of a neat Circuit Diagram. Draw waveforms and state the formula for frequency.

⟹ Working of IC 555 Astable Multivibrator :

- When the power is turned 'ON' consider the flip flop is cleared initially, then the o/p of the inverter will be high. The charging of the capacitor will be done using two resistors R_1 & R_2.
- When the voltage of the capacitor goes above 2/3 Vcc, then the output of the higher comparator will be high, it changes the control flip flop. So the control flip flop's Q o/p will be a 'LOW' & $\bar{Q}$ will be high. So the final o/p of the Inverter is 'LOW'.
- At the same time the Q1 transistor switches 'ON' and the C1 capacitor starts discharging through resistor R2.
- When the voltage of the capacitor is < 1/3 Vcc, then the o/p of the lower comparator will be high and control flip flop gets is set to 1.
- When the discharge transistor Q1 gets off, then the capacitor gets charged and continues this process.
- According to the status of the o/p, the LED at the output will blink.
- When the low voltage is applied at the 4th pin. (reset pin) of the IC then it resets the IC.

- When the low signal is applied to the base of the Q2 transistor then its switches ON by the capacito

* Waveform :



* Derive formula of frequency :

If. TON is the time for high output and T is the time period of one cycle, then the duty cycle D is given by

$$D = T_{ON}/T$$

and $$\%D = (T_{ON}/T) \times 100.$$

The value of T_{ON} or the charge time T_C is given by

$$T_C = 0.693 \times (R_1 + R_2)C$$

The value of T_{off} or T_D is given by

$$T_D = 0.693 \times R_2C$$

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Therefore, the time period for one cycle T is given

$$T = T_{ON} + T_{off} = T_C + T_D$$

$$T = 0.693 \times (R1 + R2)C + 0.693 \times R2C$$

$$T = 0.693 \times (R1 + 2R2)C$$

$$\therefore \%D = \frac{(0.693 \times (R1 + R2)C)}{(0.693 \times (R1 + 2R2)C)} \times 100$$

$$\therefore \%D = \frac{((R1 + 2R2))}{(R1 + 2R2)} \times 100$$

$$\therefore f = \frac{1}{T} = \frac{1}{0.693 \times (R1 + 2R2)C}$$

$$\therefore f = \frac{1.44}{((R1 + 2R2)C)} \text{ Hz.}$$