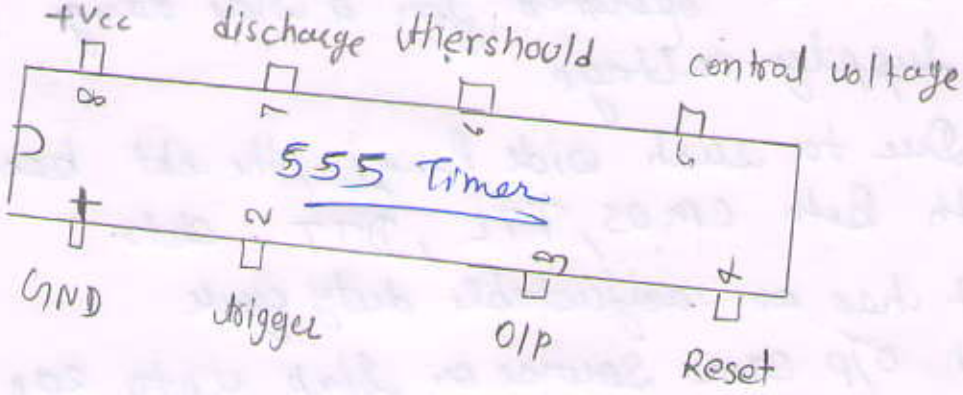
EL- 307 II Test (Linear Integrated ckts and Design)

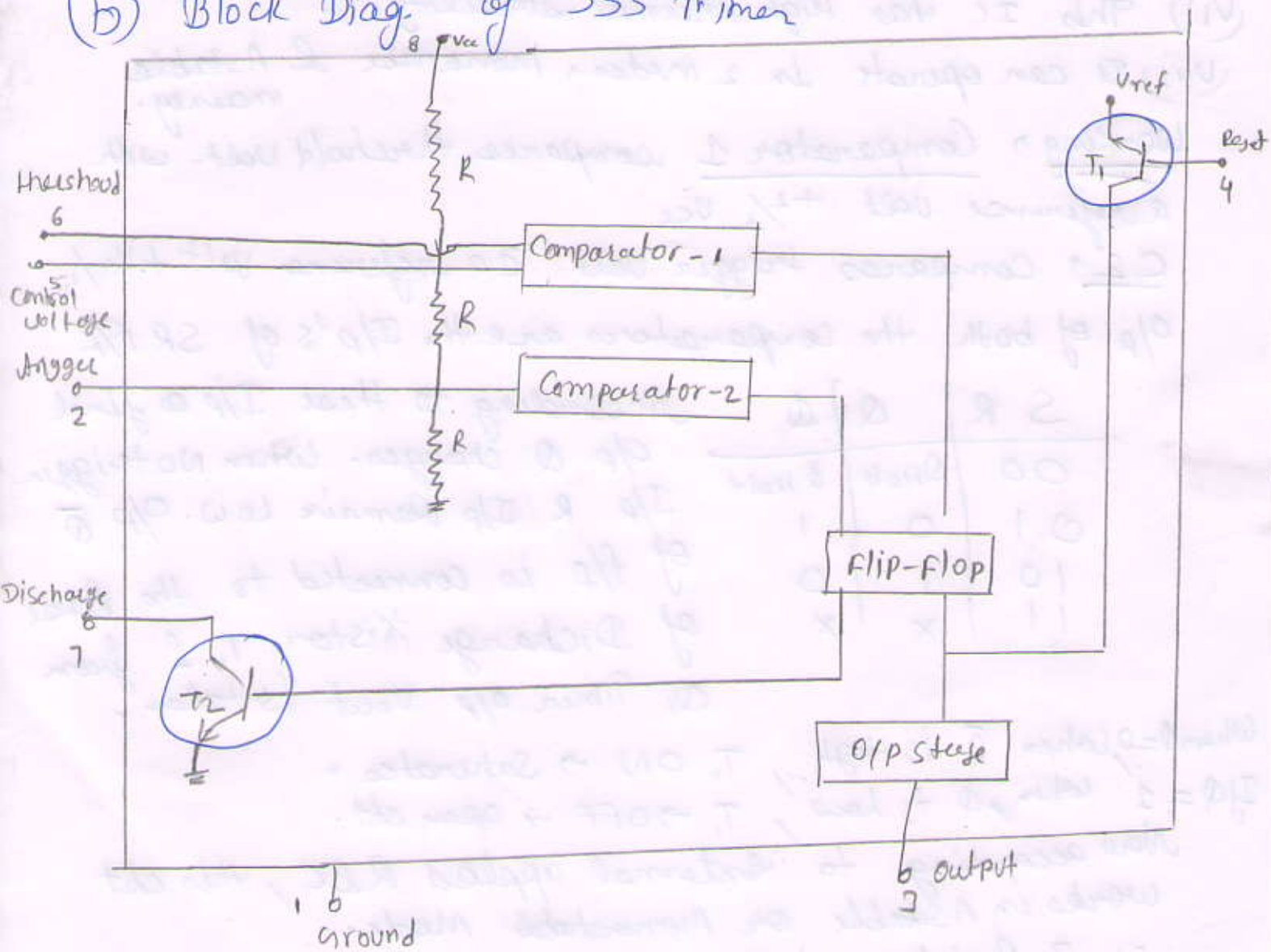
10/1/18

Q(1) Write Short Note on I.C 555 Timer.

(a) PIN Diag.



(b) Block Diag. of 555 Timer



IC 555 is a most popular IC having features.

(i) It can produce accurate time delays of time periods ranging from uses to several hrs.

(ii) It can be operated for a wide Range (+5 to +15V) of supply voltage.

(iii) Due to such wide Range, the ckt becomes compatible with Both CMOS, TTL, DTT ckts.

(iv) It has an adjustable duty cycle.

(v) It o/p can Source or Sink upto 200 mA

(vi) It has a High current o/p

(vii) This IC has High thermal Stability.

(viii) It can operate in 2 modes, Monostable & Astable mainly.

Working → Comparator 1 compares threshold volt. with a reference volt. $+2/3\ V_{cc}$

C2 → compares trigger volt. ∴ a reference volt $+V_{cc}/3$

O/p of both the comparators are the I/p's of SR F/F.

S	R	Q	$\bar{Q}$
0	0	Q_{Hold}	$\bar{Q}_{Hold}$
0	1	0	1
1	0	1	0
1	1	X	X

According to these I/p o final O/p Q changes. When No trigger I/P R I/p Remain Low. O/p $\bar{Q}$ of f/f is connected to the Base of Discharge Resistor T_1 & from Q_1 Timer o/p Vout is taken.

When Q=0, when $\bar{Q}$ is High, T_1 ON → Saturates.

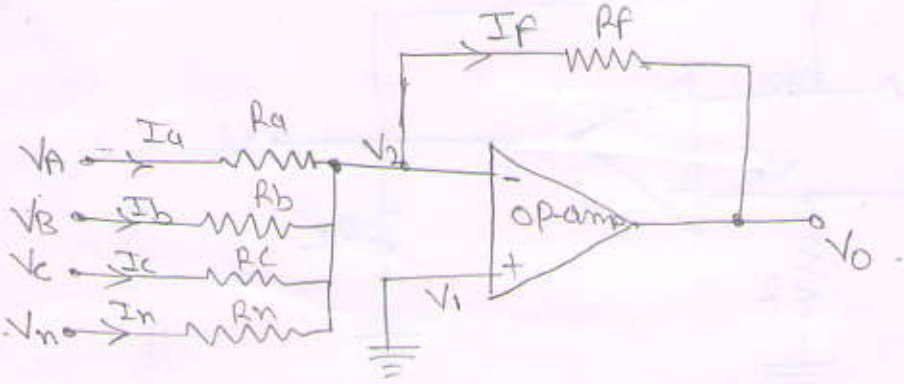
If Q = 1 when, $\bar{Q}$ is low, T_1 → OFF → open ckt.

Now according to external applied R&C, this ckt works in Astable or Monostable Mode.

∴ 3 Resistors of 5KΩ are connected in Series, so it's called 555 Timer.

Q(2) Explain the working of Adder & Subtractor using op-amp.

Adder →



op-amp की Input Resistance तथा Voltage अन्नत मानने पर

$$I_a + I_b + I_c + \cdots + I_n = I_f$$

Apply KCL at Node V_2

$$I_a + I_b + I_c = I_f + I_B$$

$$I_a + I_b + I_c = I_f$$

या

$$\frac{V_a - V_2}{R_a} + \frac{V_b - V_2}{R_b} + \frac{V_c - V_2}{R_c} = \frac{V_2 - V_o}{R_f} \quad \text{— (3)}$$

high input impidence Approximate

$$I_B \cong 0$$

$$V_1 = V_2 = 0$$

$$V_2 \cong 0$$

समी. (3) से.

$$\frac{V_a}{R_a} + \frac{V_b}{R_b} + \frac{V_c}{R_c} = -\frac{V_o}{R_f}$$

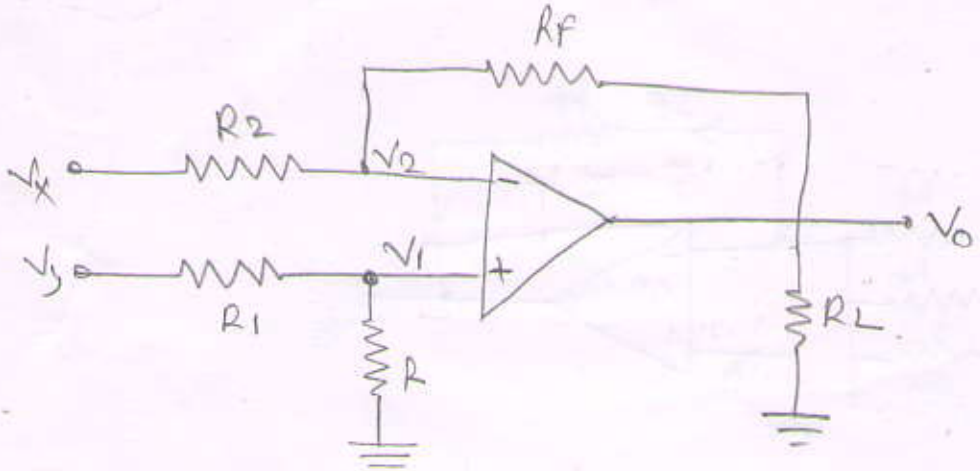
$$R_a = R_b = R_c = R_{in}$$

$$= \frac{1}{R_{in}} (V_a + V_b + V_c)$$

If $R_f = R_a = R_b = R_c$ then o/p Volt = -ve Sum of I/p Voltage

then → $\boxed{V_o = -(V_a + V_b + V_c)}$

Subtractor →



$$V_o = \frac{R_f}{R_1}\left[-V_y - V_x\right]$$

V_x = Voltage at inverting terminal
V_y = Voltage at non-Inverting terminal

→ यदि opamp के gain को unity कर दिया जाए तो

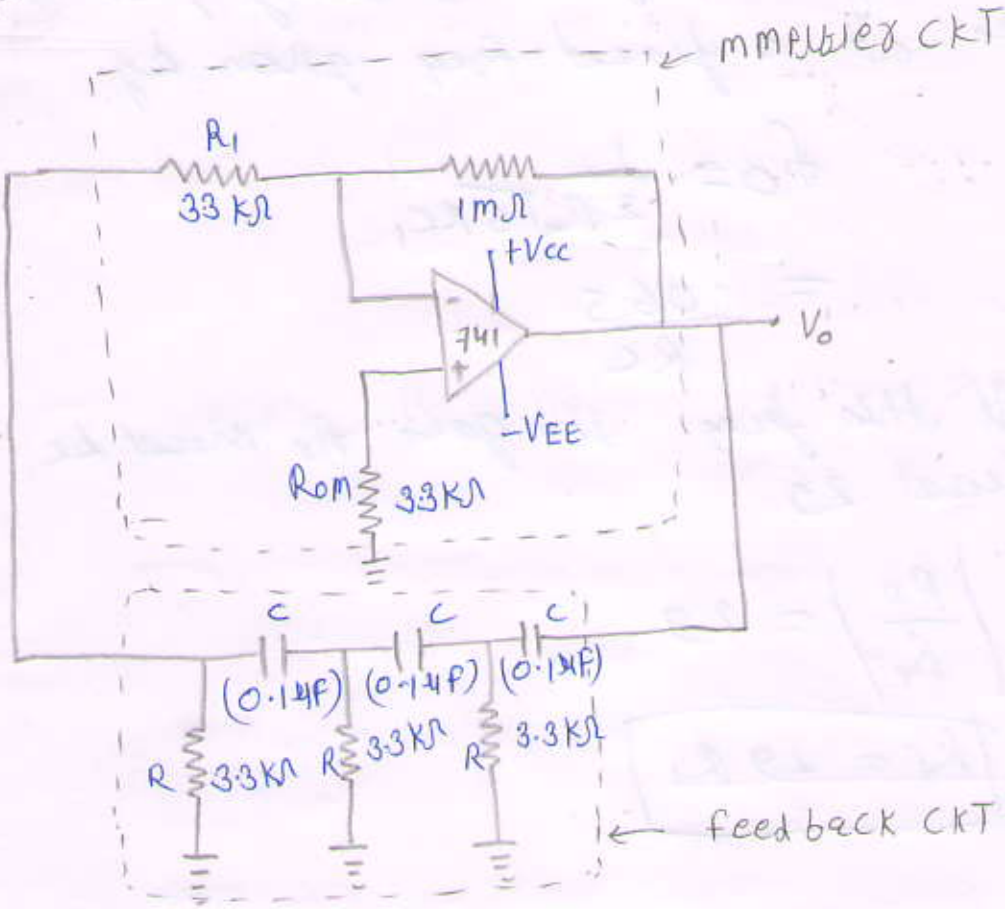
$$R_1 = R_f = R$$

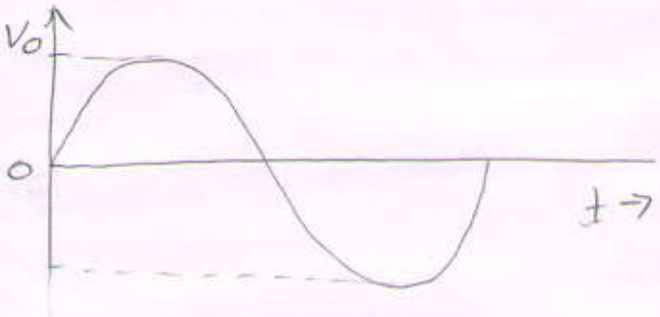
$$V_o = V_y - V_x$$

Hence O/p Volt. is equal to the difference of I/p Voltages V_y & V_x.
Hence It is called Subtractor.
Similarly we can increase the No. of Inputs as Adder

Q3) Explain RC- phase shift Oscillator using op-amp 741 IC.

Ans →





R-C Phase Shift OSCILLATOR में एक OP-AMP और तीन R-C cascade Network होते हैं। The Cascade N/w feedback loop में होता है।

The f/b ckt is used to provides f/b volt. from o/p Back to I/p of the Amplifier.

The o/p is used in the Inverting Mode, therefore any signal that appears at the Inverting terminal is shifted by 180° at the o/p. An additional 180° phase shift is required for Oscillation

It is provided by 3 R-C N/w

∵ 1 RC N/w gives 60° phase-shift. Hence
3 RC N/w gives 180° " " "

∵ Gain of Amplifier is large, so ckt will Oscillate at a fixed freq given by

$$f_o = \frac{1}{2\pi\sqrt{6}RC}$$

$$= \frac{.065}{RC}$$

At this freq. the gain A_0 must be at least 29.

$$\left|\frac{R_f}{R_1}\right| = 29$$

$$\boxed{R_f = 29 R_1}$$