SCHMITT TRIGGER:-

Design:-

Given $V_{CC} = 12V$ UTP = 5V LTP = 3V

$I_C = 2mA$ $I_2 = 0.1 I_{C_2}$. $h_{fe(min)} = 100$,

Calculation of R_E:-

UTP = $V_{B_2} = 5V$

Voltage across R_E is $V_E = V_{B_2} - V_{BE}$

$= 5 - 0.7 = 4.3V$.

$$V_E = 4.3V$$

$I_E = I_C = 2mA$

$$R_E = \frac{V_E}{I_E} = \frac{4.3}{2 \times 10^{-3}} = 2.15k\Omega$$

$$R_E = 2.15k\Omega$$

Calculation of R_{C2}:-

Taking Q_2 as saturated, $V_{CE(sat)} = 0.2V$

$I_C R_{C_2} = V_{CC} - V_E - V_{CE(sat)}$

$= 12 - 4.3 - 0.2 = 7.5V$

$\Rightarrow$

$$R_{C_2} = \frac{7.5}{I_C} = \frac{7.5}{2 \times 10^{-3}}$$

$$\boxed{R_{C_2} = 3.75\,K\Omega}$$

Calculation of R_2:-

$$I_2 = \frac{I_{C2}}{10} = 0.1 \times 2 \times 10^{-3}$$

$$I_2 = 0.2\,mA$$

$$R_2 = \frac{V_{B2}}{I_2} = \frac{5}{0.2 \times 10^{-3}}$$

$$\boxed{R_2 = 25\,K\Omega}$$

Calculation of R_{C1}, R_1 and R_E

$$I_{B_2} = \frac{I_{C2}}{h_{fe(min)}} = \frac{2 \times 10^{-3}}{100}$$

$$I_{B_2} = 2 \times 10^{-5} = 20 \times 10^{-6}\,A$$

$$\boxed{I_{B_2} = 20\,\mu A}$$

(2)

$$I_1 = I_2 + I_{B2} = 0.2\times10^{-3} + 20\times10^{-6}$$

$$= 2.2\times10^{-4}\,A$$

$$\boxed{I_1 = 0.22\,mA}$$

$$I_1 = \frac{V_{cc} - V_{B2}}{R_{c1} + R_1} = \frac{12-5}{R_{c1}+R_1} = 0.22\times10^{-3}$$

$$R_{c1} + R_1 = \frac{7}{0.22\times10^{-3}} = 31.8\,K\Omega$$

$$\boxed{R_{c1} + R_1 = 31.8\,K\Omega}$$

(II) Q_1 is ON, V_i = LTP $V_{B2} = 3V$.

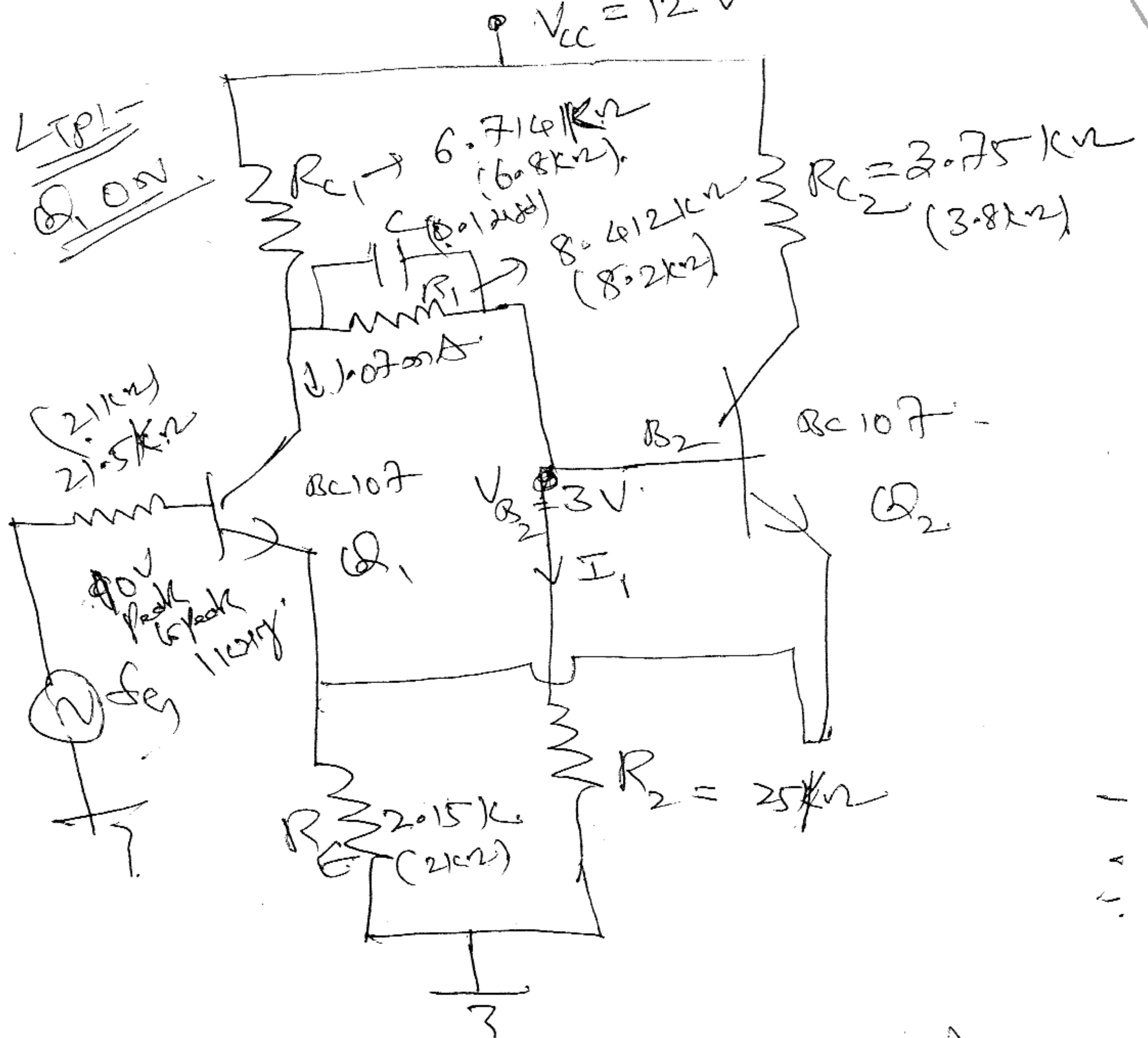
$$I_1 = \frac{V_{B2}}{R_2} = \frac{3V}{25\times10^{3}} = 0.12\,mA$$

$$\boxed{I_1 = 0.12\,mA}$$

$$I_{C1} = I_E = \frac{V_{B1} - V_{BG}}{R_E} = \frac{3-0.7}{2.15\times10^{3}}$$

$$I_{C1} = I_E = 1.07\,mA$$

III.



$$V_{CC} = R_{C1}(I_{C1} + I_1) + I_1(R_1 + R_2)$$

$$V_{CC} = R_{C1}(I_{C1} + I_1) + I_1(R_1 + R_2)$$

$$R_{C1} = \frac{V_{CC} - I_1(R_1 + R_2)}{I_{C1} + I_1}$$

$$R_{C_1} = \frac{12 - (0.12\,mA)(R_1 + 25k\Omega)}{(1.07 + 0.12)\,mA}$$

$$R_{C_1} + R_1 = 31.8\,k\Omega$$

$$1.19\times10^{-3} R_{C_1} = 12 - 0.12\times10^{-3} R_1 - 3$$

$$1.19\times10^{-3} R_{C_1} + 0.12\times10^{-3} R_1 = 9$$

$$R_{C_1} + R_1 = 31.8\times10^{3}$$

$$1.19\times10^{-3} R_{C_1} + 1.19\times10^{-3} R_1 = 37.842$$

$$1.19\times10^{-3} R_{C_1} + 0.12\times10^{-3} R_1 = 9$$

$$1.07\times10^{-3} R_1 = 9$$

$$\therefore R_1 = \frac{9}{1.07\times10^{-3}} = 8.4112\,k\Omega$$

$$\boxed{\therefore R_1 = 8.4112\,k\Omega}$$

$$R_{C_1} = \frac{9 - 0.12\times10^{-3} \times 8.4112\times10^{3}}{1.19\times10^{-3}}$$

$$= \frac{9 - 1.0093}{1.19\times10^{-3}} = 6.714\,k\Omega$$

$$\boxed{R_{C_1} = 6.714\,k\Omega}$$

3

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D.EX GCE

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Sub: Hospital Management — Time: 2 Hrs.

Sem: VII —————— Max Marks: 50

Year/Branch: IV | BME —— Date:

PART-A (7x2=14 Marks).

(Answer all the questions).

1

2

3

PART-B (3x12=36 Marks).

(Answer any three).

RC phase shift 5th

RAVI RANJAN

2

(4-1)

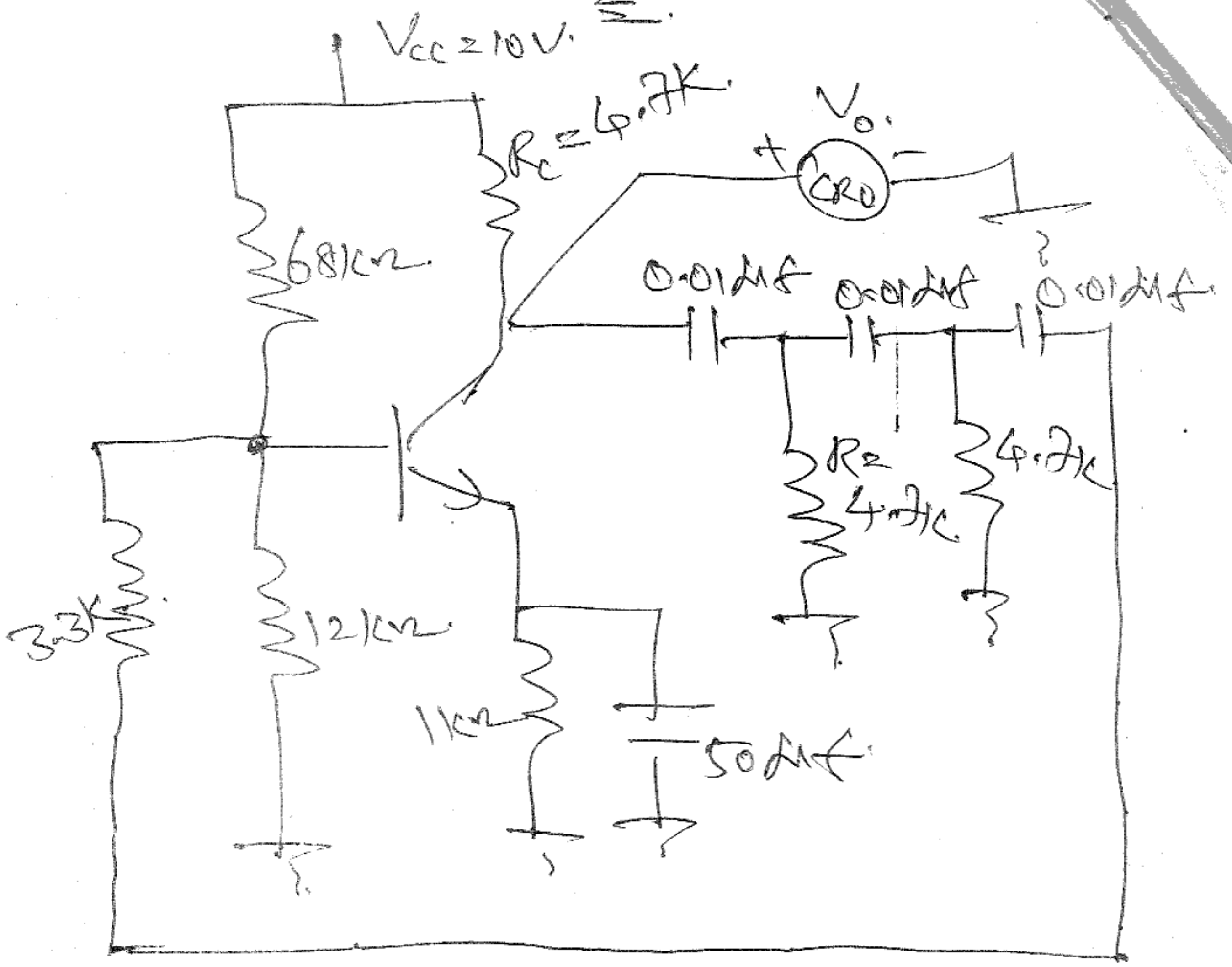
(4) RC PHASE SHIFT OSCILLATOR:-

4.1 Aim:-

To design a RC phase shift Oscillator and to find the frequency of oscillation.

4.2 Apparatus Required:-

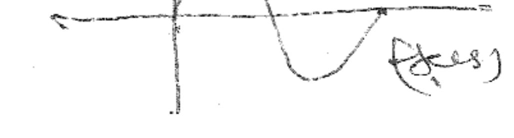
S.No.	Apparatus Required	Range	Quantity
1.	Resistors	68K	1
		12K	1.
		4.7K	3
		1K	1.
		3.3K	1.
2.	Power supply	0-30V	1.
3.	Transistor	BC107	1.
4.	Capacitors	50nf	1.
5.	CRO		1.
6.	Bread Board. & &		1.



Tabulation :-

Amplitude volts	Time Period (To) (ms)

Model Graph :-



Calculation :-

Frequency:

$$f = \frac{1}{T_0}.$$

4.3. Design specifications:-

$V_{CC} = 10V$ $I_{cq} = 1mA$ $\beta = 345$

$f = 1KHz$ $C = 0.01\mu F$ $A_V = 29$.

$h_{ie} = 1.1K$ $S = ~~10~~.11$.

Calculation of R_E and R_C:-

$V_{CE} = \frac{V_{CC}}{2} = \frac{10}{2} = 5V$.

$V_E = \frac{10}{10} = 1V$.

$I_{CE} = 1mA$ $\boxed{\therefore R_E = 1K\Omega}$

$V_{CC} = I_C R_C + V_{CE} + I_E R_E$

$10 = (1 \times 10^{-3}) R_C + 5 + 1$.

$\frac{4}{1 \times 10^{-3}} = R_C$ $\therefore R_C = 4K\Omega$

$\boxed{R_C = 4.7K\Omega}$

Calculation of R in the feedback network:-

$f = 1 KHz.$

$$f = \frac{1}{2\pi RC\sqrt{4k+6}}$$

$k = 1.$

$$\therefore f = \frac{1}{2\pi RC\sqrt{10}}$$

$$\therefore R = \frac{1}{2\pi(1\times10^3)(0.01\times10^{-6})\sqrt{10}}$$

$R =$

$R_c = kR.$

$k = 1$

$R_c = R.$

$$\therefore R = 4.7K.$$

To find R_3:-

$R_3 + h_{ie} = R.$

$R_3 = R - h_{ie}.$

$= 4.7K - 1.1K = 3.6K.$

$\boxed{R_3 = 3.3 k\Omega}$

Calculation of R_1 and R_2:-

$V_{BB} = \frac{V_{CC} R_2}{R_1 + R_2}.$

$V_{BE} = V_B - V_E.$

$\therefore V_B = V_{BE} + V_E = 0.7 + 1. = 1.7V.$

$\boxed{\therefore V_{BB} \approx 1.5V}$

$S = 1 + \frac{R_B}{R_E}$

2

$(11-1) = \frac{R_B}{R_E}$ $\therefore R_B = 10 R_E$

$R_B = 10 \times 1K$

$\boxed{R_B = 10K}$

$R_B = \frac{R_1 R_2}{R_1 + R_2} = 10K$

$V_{BB} = \frac{V_{CC} R_2}{R_1 + R_2}$

$\frac{R_2}{R_1 + R_2} = \frac{V_{BB}}{V_{CC}} = \frac{1.5}{10} = 0.15$

$10K = R_1 (0.15)$ $\therefore R_1 = \frac{10K}{0.15}$

$R_1 = 66.67 K$

$\boxed{\therefore R_1 = 68K\Omega}$

$\frac{2}{2}$ (4-4)

$$\frac{R_1 R_2}{R_1 + R_2} = 10K$$

$$\frac{10K}{68K} = \frac{R_2}{R_1 + R_2}$$

$$\frac{68K(R_2)}{R_1 + R_2} = 10K$$

$$\frac{68K}{10K} = \frac{R_1 + R_2}{R_2}$$

$$6.8 = 1 + \frac{R_1}{R_2}$$

$$\therefore \frac{R_1}{R_2} = 5.8$$

$$\therefore R_2 = \frac{R_1}{5.8} = \frac{68K}{5.8} = 11.72k$$

$$\therefore R_2 = 12k\Omega$$

$$X_{CE} = \frac{h_{ie}}{1+\beta} = \frac{1.1 \times 10^3}{1 + 365}$$

$$X_{CE} = 3.18$$

$$C_E = \frac{1}{2\pi f X_{CE}}$$

$$= \frac{1}{2\pi (1 \times 10^3)(3.18)}$$

$C_6 = 50\mu F$.

Result :-

RC phase shift Oscillator is designed and the Practical frequency is observed as ______.

HARTLEY OSCILLATOR:-

Aim:-

To design and Construct a Hartley Oscillator at the given operating frequency.

Apparatus required:-

Sl.no:	Apparatus	Range	Quantity
1.	Resistors	100K	1.
		22K	1.
		2K	1.
		1K	1.
2	RPS	(0-30)V.	1.
3.	Transistor	BC107	1
4.	Capacitors	3.2nf	1
		0.1μf	1
		0.01μf	2
5	Inductor	10mH	2
6	CRO	30MHz	1.
7	Bread Board.		1.

8-3 Design Example:-

Design of feedback network:-

Given $L_1 = L_2 = 10mH$, $f = 20kHz$

$V_{CC} = 12V$ $I_C = 3mA$, $S = 12$.

$$f = \frac{1}{2\pi\sqrt{(L_1 + L_2)C}}$$

$$\sqrt{C} = \frac{1}{2\pi\sqrt{L_1 + L_2} \cdot f}$$

$$C = \frac{1}{4\pi^2 (L_1 + L_2) f^2}$$

$$= \frac{1}{4\pi^2 (20 \times 10^{-3}) (20 \times 10^{3})^2}$$

$$\boxed{C = 3.2 \text{ nano farad}}$$

2

Amplifier design:-

(i) selection of R_C.

Gain formula is:

$$A_V = -\frac{h_{fe} R_{L\,eff}}{h_{ie}}$$

Assume $V_{CE} = \frac{V_{CC}}{2} = \frac{12}{2} = 6V$.

$$V_E = I_E R_E = \frac{V_{CC}}{10} = \frac{12}{10} = 1.2V.$$

$$V_{CC} = I_C R_C + V_{CE} + I_E R_E.$$

$$R_C = \frac{V_{CC} - V_{CE} - I_E R_E}{I_C}.$$

$$= \frac{12 - 6 - 1.2}{3 \times 10^{-3}}.$$

$R_C = 1.6\,K\Omega$

$\boxed{R_C \approx 2K\Omega}$

(ii) <u>Selection of R_E:-</u>

$I_C = I_E = 3mA$.

$R_E = \frac{V_E}{I_E}$ $\boxed{R_E = 1K\Omega}$.

$R_E = \frac{1.2}{3\times10^{-3}} = 400\Omega \approx 1K\Omega$

(iii) <u>Selection of R_1 & R_2:-</u>

$S = 1 + \frac{R_B}{R_E} = 12$.

$\frac{R_B}{R_E} = 11$ $R_B = (11)(R_E) = 11K\Omega$.

$\boxed{R_B = 11K}$.

$R_B = \frac{R_1 R_2}{R_1+R_2}$ $V_B = \left(\frac{R_2}{R_1+R_2}\right)V_{CC}$.

$\frac{R_2}{R_1+R_2} = \frac{V_B}{V_{CC}} = \frac{1.9}{12} = \underline{0.1583}$.

$V_{BE} = V_B - V_E$

$V_B = V_{BE} + V_E$
$= 0.7 + 1.2$
$= 1.9V$

$\frac{3}{2}$

$111K = R_1 . (0.1583)$

$R_1 = \frac{111K}{0.1583} = 69.49$

$\therefore R_1 = 100 K\Omega$

$\frac{R_2}{100K + R_2} = 0.1583$

$\frac{100K}{R_2} + 1 = \frac{1}{0.1583}$

$\frac{100K}{R_2} = 5.3171$

$R_2 = \frac{100K}{5.3171}$

$R_2 = 18.8K$ $\quad R_2 = 22 K\Omega$

(iv) Output Capacitance (C_0) :-

$X_{C_0} = \frac{R_C}{10} = \frac{2 \times 10^{3}}{10} = 2 \times 10^{2} = 200 \Omega$

$\frac{1}{2\pi f C_0} = 200$ $\quad \therefore C_0 = \frac{1}{(2)(3.14)(20 \times 10^{3})(200)}$

$C_0 = 0.039 \times 10^{-6}$ farad

$C_0 = 0.01 \mu fd.$

=

(v) Input Capacitance (C_i):-

$$X_{C_{in}} = \frac{R_B}{10} = \frac{11\times10^3}{10} = 1.1 k\Omega$$

$$\frac{1}{2\pi f C_{in}} = 1.1\times10^3$$

$$C_{in} = \frac{1}{2\pi(20\times10^3)(1.1\times10^3)}$$

$$C_{in} = 0.007 \text{ μfarad} = 0.01 μf$$

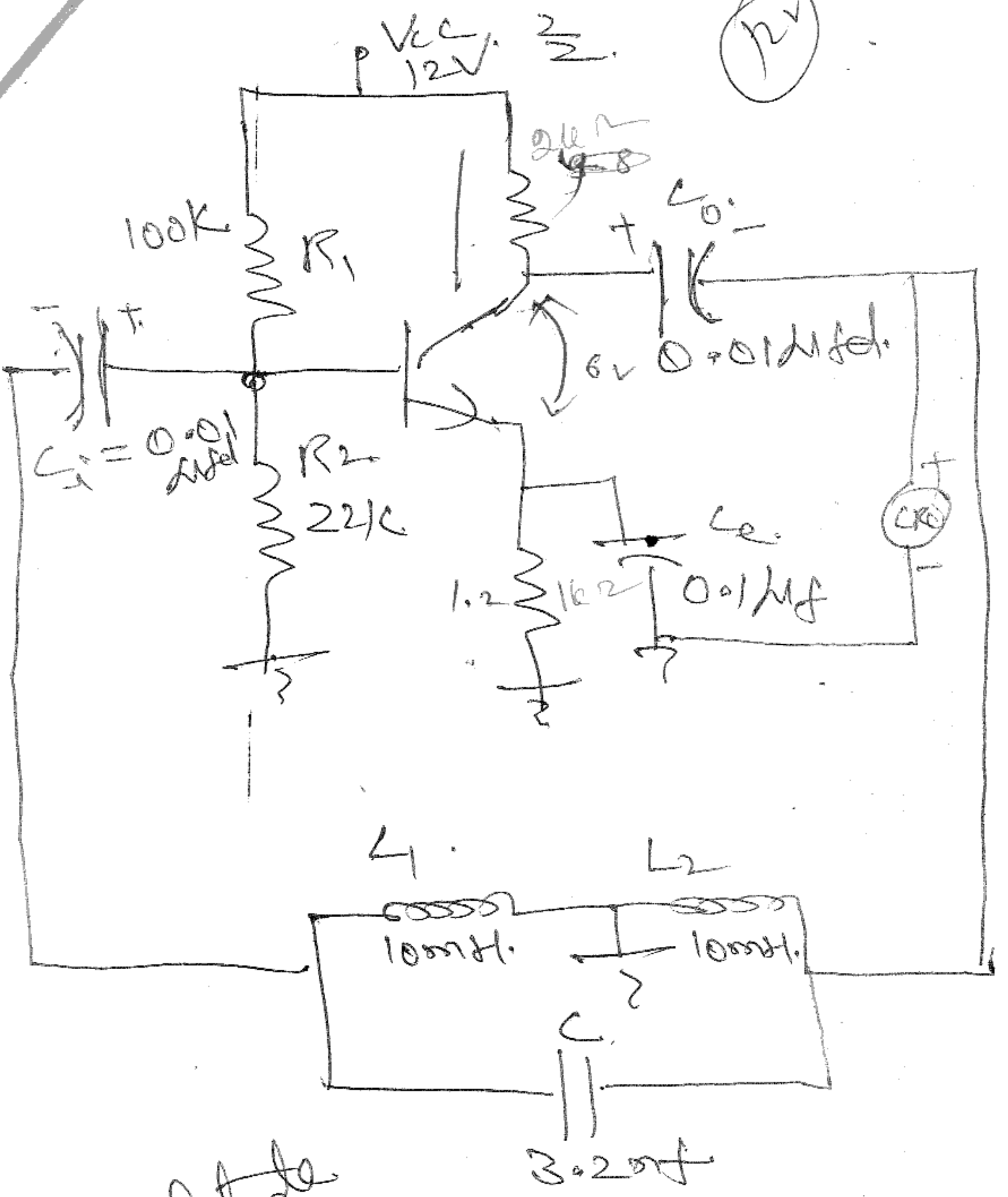
(vi) By Pass Capacitance (C_G):-

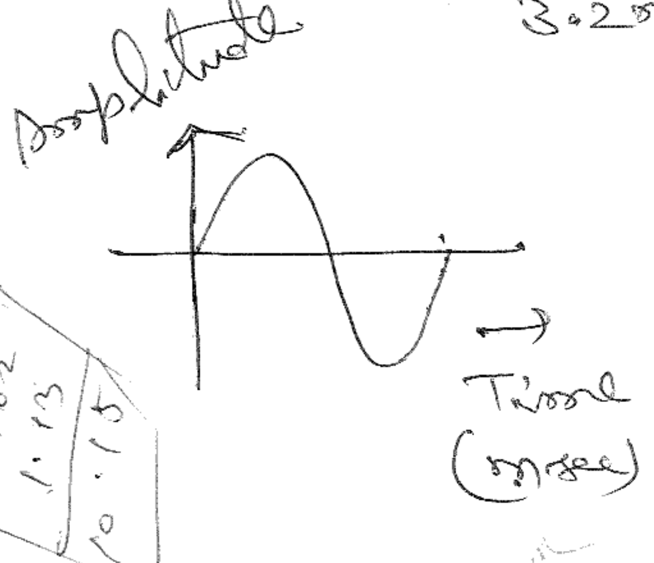
$$X_{CG} = \frac{R_G}{10} = \frac{1\times10^3}{10} = 100\Omega$$

$$\frac{1}{2\pi f C_G} = 100$$

$$C_G = \frac{1}{2\pi(20\times10^3)(100)}$$

$$C_G = 0.079 μf = 0.1 μf$$





f
2.30
6.62
1.13
10.15

VCE 7.57
1.46
VE 2.97
11.80

Tabulation:-

Amplitude	Time range	Frequency (Hz)

Result:-

The Hartley oscillator is designed and constructed for the given frequency.

Theoretical frequency:

Practical frequency:

COLPITT OSCILLATOR:-

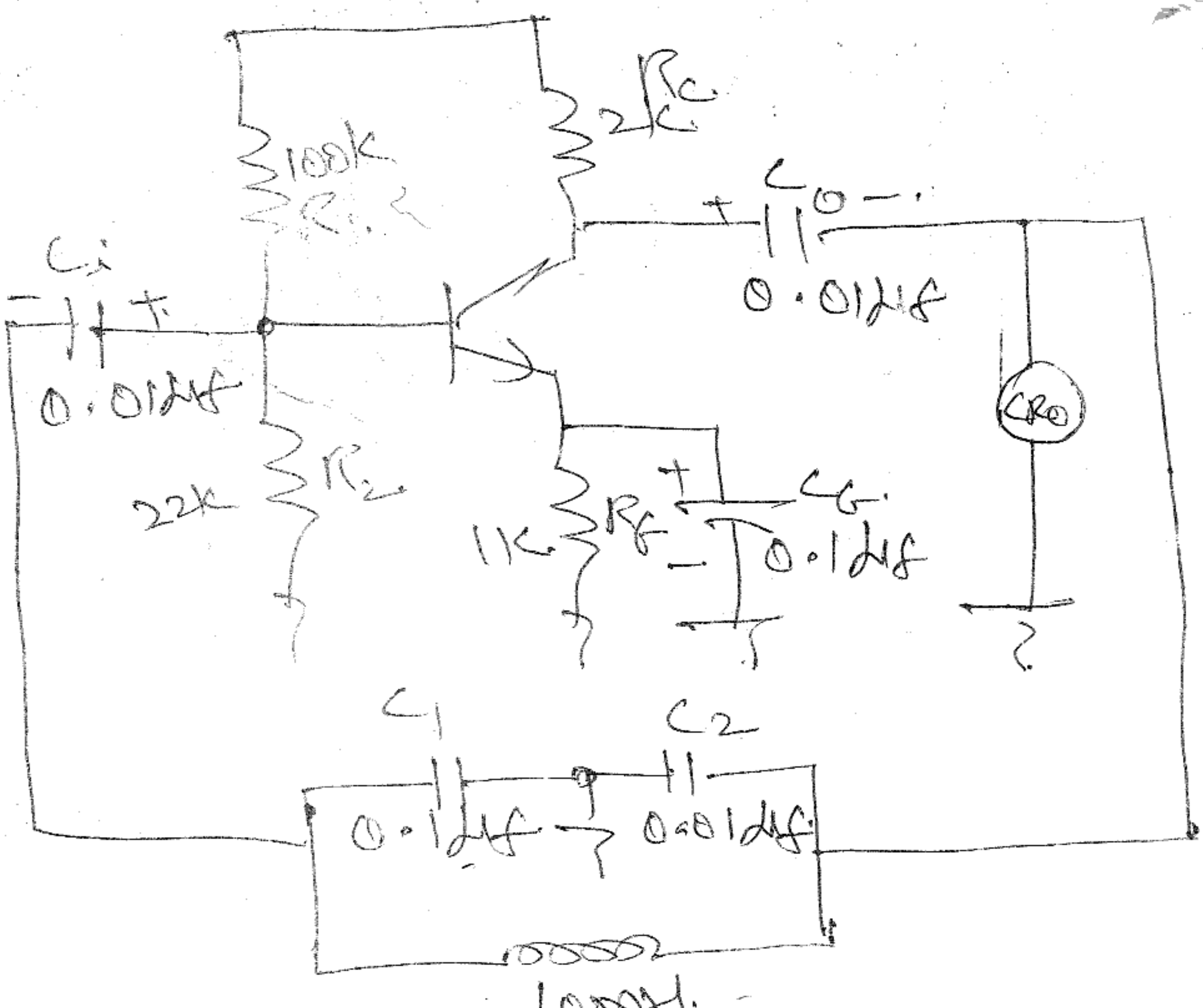
Aim:-

To design and Construct a Colpitts oscillator at the given operating frequency.

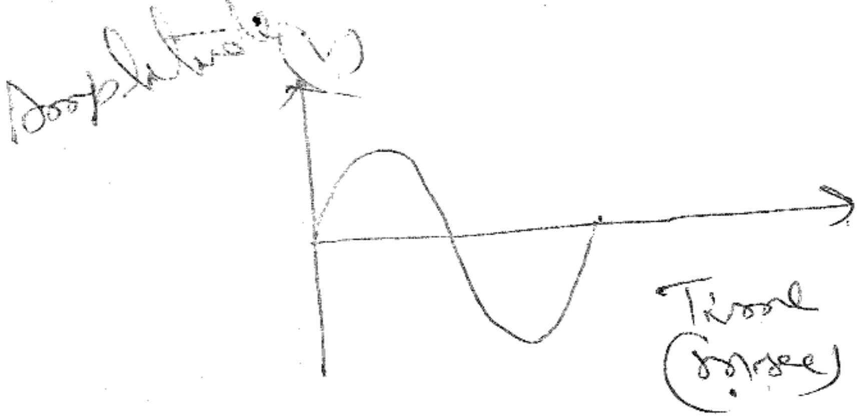
Amplifier is same as Hartley.

Apparatus required:-

S.No.	Apparatus	Range	quantity
1.	Resistors	2kΩ	1
		1kΩ	1
		100kΩ	1
		22kΩ	1
2.	RPS	0-30V	1.
3.	Transistor	BC107	1.
4.	Capacitors	0.1μf	1
		0.01μf	1.
5	Inductor	10mH	1.
6	CRO	30 MHz	1.
7	Breadboard		1


Rc
100k
R1
Ci
0.01μf
22k
R2
1k
Re
Co
0.01μf
CRO
CE
0.1μf
C1
C2
0.1μf
0.01μf
100mH

MODEL GRAPH -


Amplitude (V)
Time (msec)