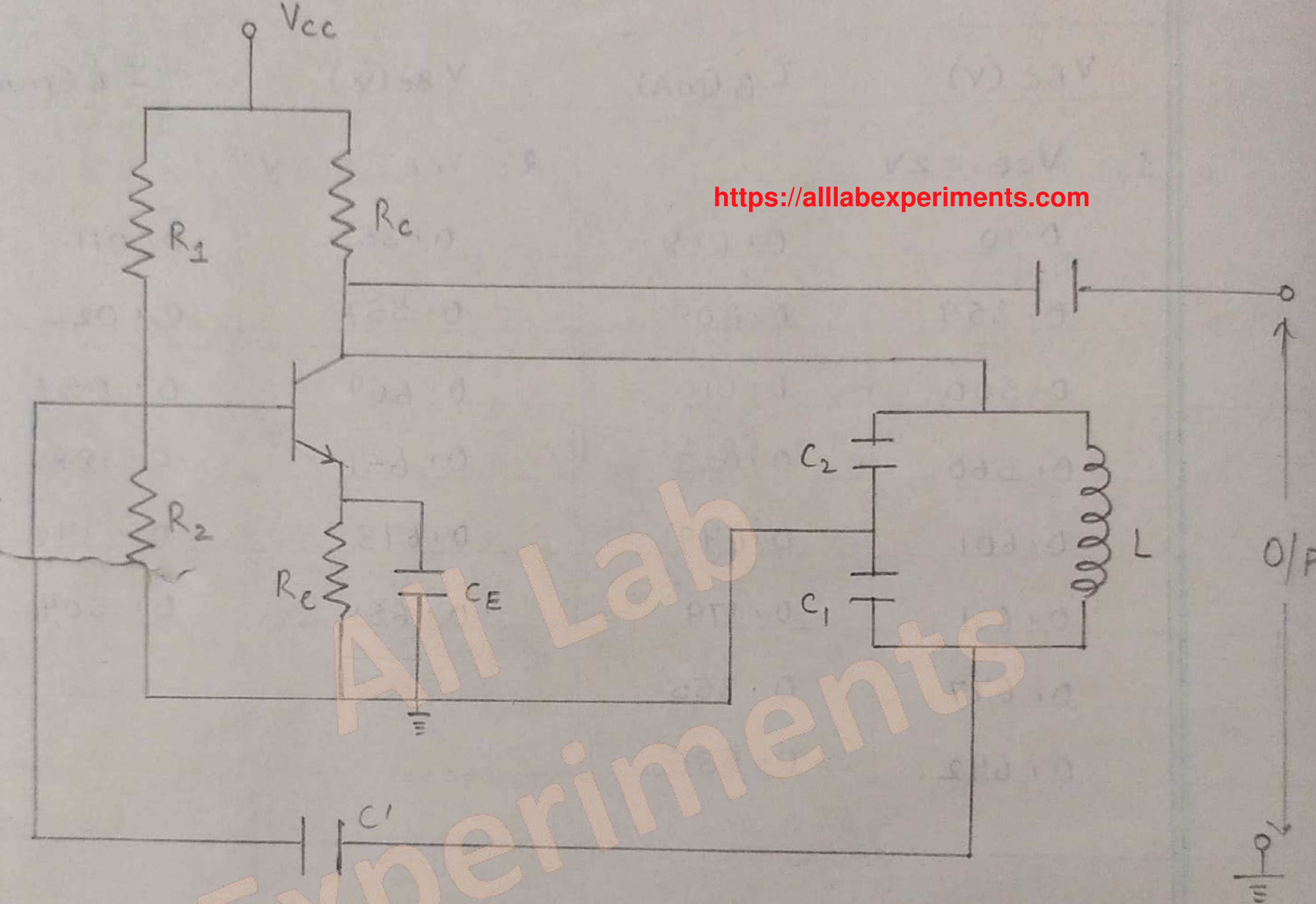
EXPERIMENT NO, 10

AIM → To study the frequency variation in Colpitts Oscillator.

APPARATUS → Experimental board on colpitts oscillat-or, CRO, connecting wires.

THEORY → An electronic oscillator is actually a power convertor. It takes power from a DC supply and converts it into a time varying voltage with the help of an active device. The active device has to work in conjugation with passive networks.

Colpitts oscillator makes use of a tuned circuit as a frequency determining network in the feedback path. (FIG). The biasing arrangement is same as that used in a CE stage. The feedback is provided by the tuned ckt. consisting of L_1, C_1 and C_2.



CIRCUIT DIAGRAM.

The frequency of the oscillator is given by

$$\omega^2 = \frac{C_1 + C_2}{L C_1 C_2}$$

PROCEDURE → 1. Connect a CRO across the output terminals.

2. Switch on the supply and obtain a stable sine wave on CRO screen.

3. Measure the frequency and amplitude of the sinewave obtained for all the three positions of the bandswitch.

4. Compare the theoritical and practical value of the frequency of each sine wave.

OBSERVATIONS AND CALCULATIONS →

The value of L and C_1 are common for each case :-

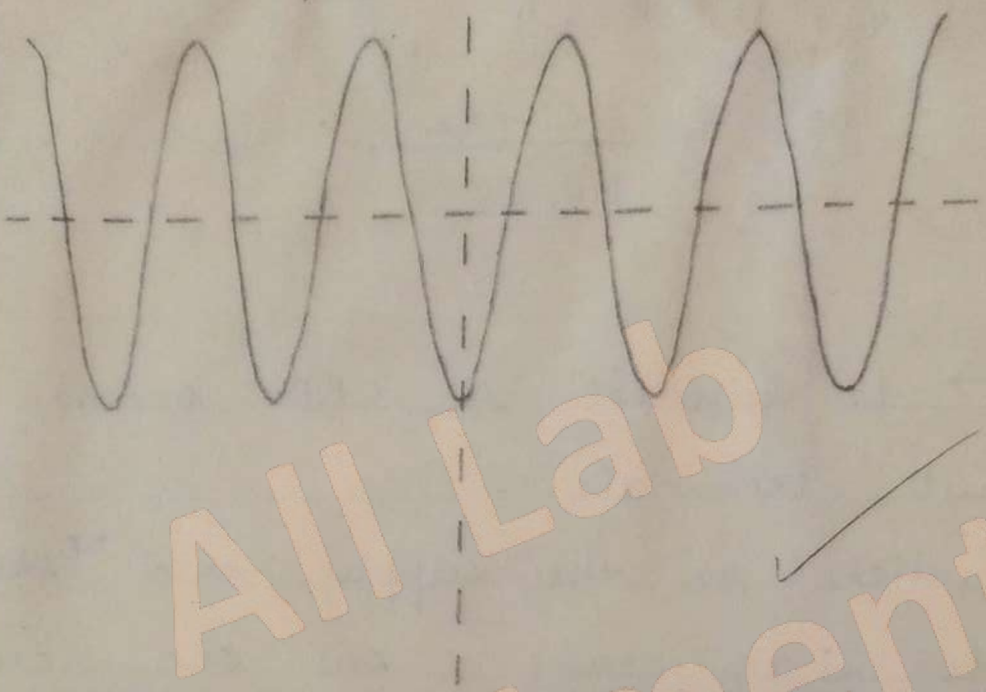
$L = 10\ \mu H$

$C_1 = 0.1\ \mu F$

C_2 ON LEFT

$V = 1.9 \times 10\ V$

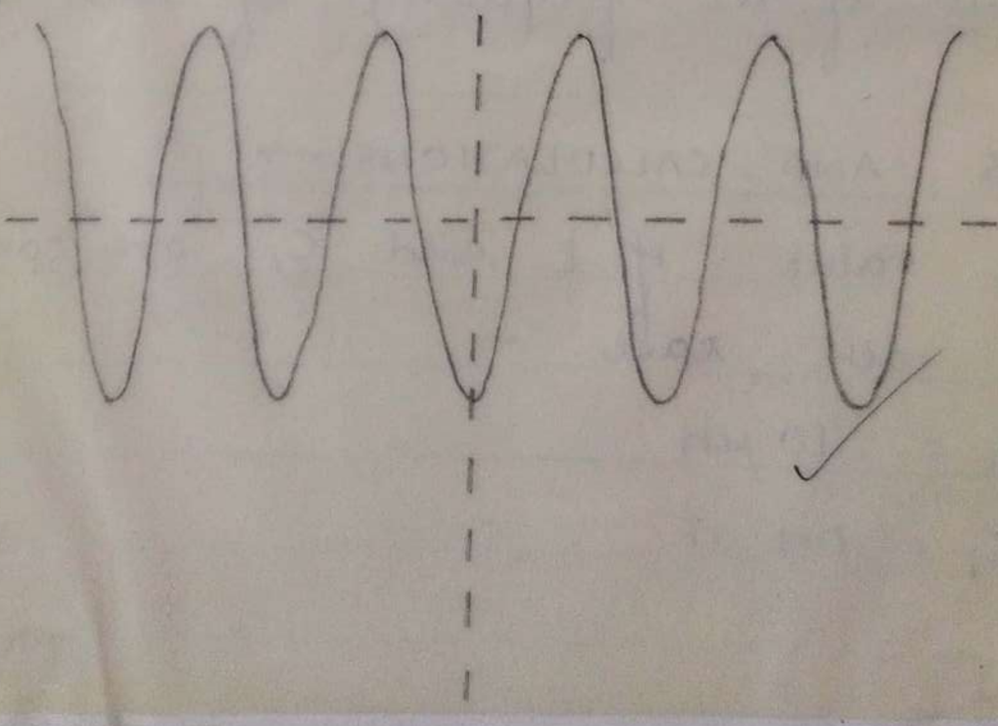
$T = 2 \times .5\ \mu s$



C_2 in MIDDLE

$V = 1.9 \times 10\ V$

$T = 2.7 \times .5\ \mu s$



1. C_2 on left side = 0.0022 μF

$$\omega^2 = \frac{(0.1 + 0.0022) \times 10^{-6}}{10 \times 10^{-6} \times 0.1 \times 10^{-6} \times 0.0022 \times 10^{-6}}$$

$$= 46.454 \times 10^{12}$$

$$\omega = 6.816 \times 10^{6} \text{ Hz}$$

OR $$f = 1.085 \times 10^{6} \text{ Hz} \quad \text{(theoretical)}$$

$$T = 2 \times 0.5 \, \mu s$$

$$f = \frac{1}{2 \times 0.5 \times 10^{-6}} = 1 \times 10^{6} \text{ Hz (practical)}$$

2. C_2 on middle = 0.0047 μF

$$\omega^2 = \frac{(0.1 + 0.0047) \times 10^{-6}}{10 \times 10^{-6} \times 0.1 \times 10^{-6} \times 0.0047 \times 10^{-6}}$$

$$= 22.276 \times 10^{12}$$

$$\omega = 4.719 \times 10^{6} \text{ Hz}$$

OR $$f = 0.7515 \times 10^{6} \text{ Hz} \quad \text{(theoretical)}$$

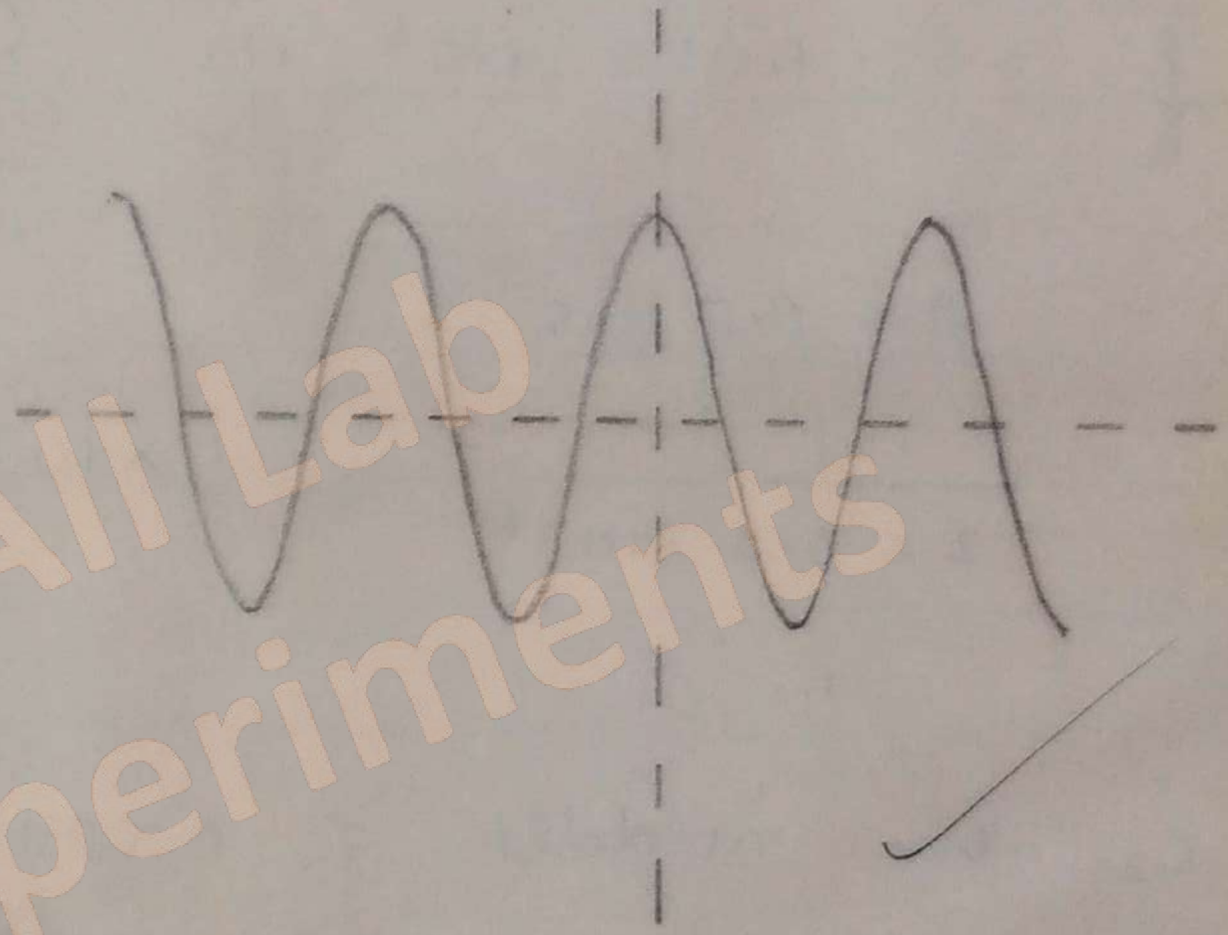
$$T = 2.7 \times .5 \, \mu s$$

$$f = \frac{1}{2.7 \times .5 \times 10^{-6}} = 0.7406 \times 10^{6} \text{ Hz (practical).}$$

C_2 ON RIGHT

V = 1·5 x 10 V

T = 3·2 x ·5 μS



3. C_2 on the right side = 0.01 μF

$$\omega^2 = \frac{(0.1 + 0.01) \times 10^{-6}}{10 \times 10^{-6} \times 0.1 \times 10^{-6} \times 0.01 \times 10^{-6}}$$

$$= 11 \times 10^{12}$$

$$\omega = 3.316 \times 10^{6} \text{ Hz}$$

OR $f = 0.528 \times 10^{6}$ Hz (theoretical)

$$T = 3.6 \times .5 \text{ μs}$$

$$f = \frac{1}{3.6 \times .5 \times 10^{-6}} = 0.555 \times 10^{6} \text{ Hz}$$

(practical)

RESULT → The practical values of frequency at given capacitances C_2 (with diff. positions) came out to be $1.00 \times 10^{+6}$ Hz, 0.7407×10^{6} Hz and 0.555×10^{6} Hz and they are in good agreement with the theoritical values obtained.

PRECAUTIONS → 1. Do not make interconnections with power supply on.

2. Handle the apparatus very carefully.