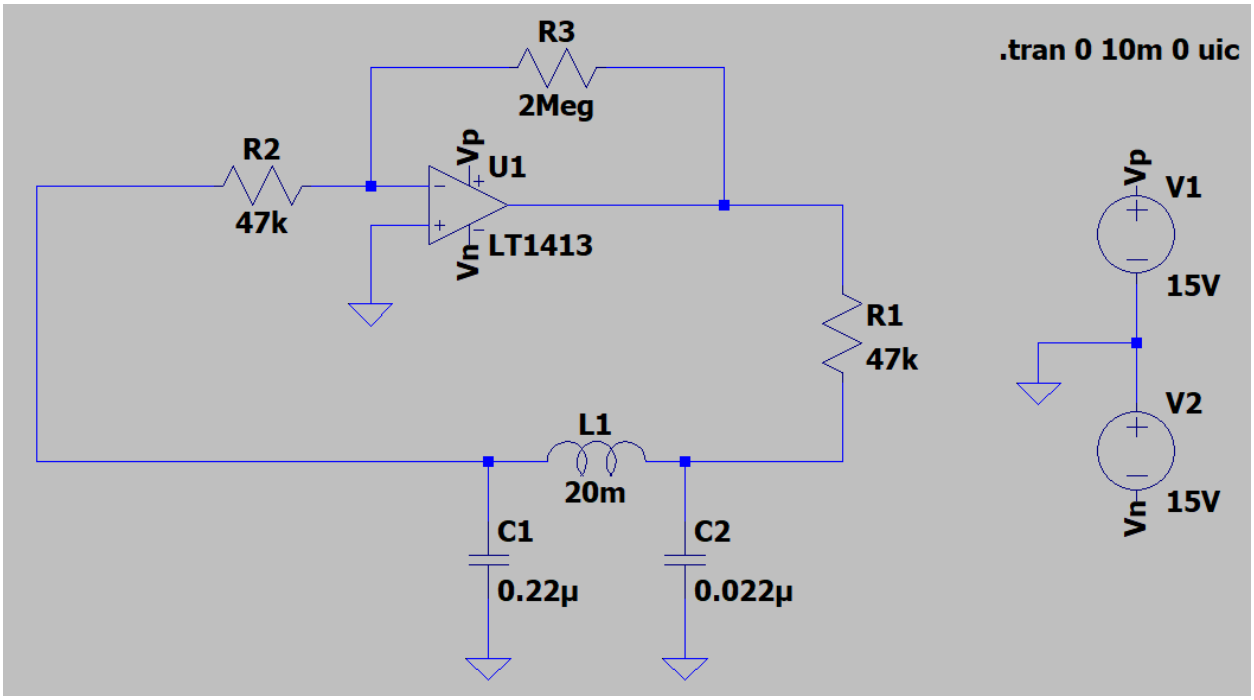
EXPERIMENT NO. 4

AIM: To study and calculate frequency of oscillations of Colpitts oscillator using LTspice

Software Required: LTspice

Circuit Diagram:



Introduction:

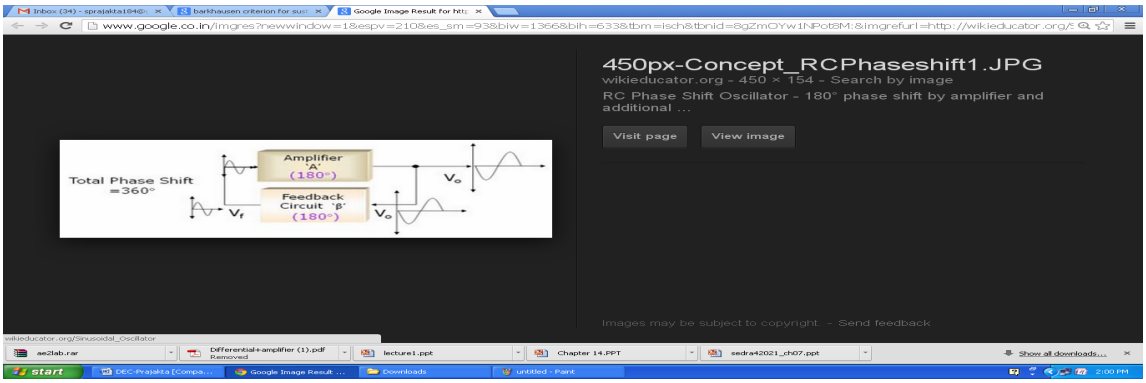
Oscillators have positive type of feedback. Positive feedback is the process when the output is added to the input, amplified again, and this process continues. In order to produce sustained oscillations the Barkhausen criteria must be satisfied.

Barkhausen criteria for sustained oscillations:

1) The total phase shift around a loop is precisely 0^0 or 360^0
2) The magnitude of product of open loop gain of amplifier and the magnitude of the feedback factor is unity.

$$|A\beta| = 1$$

In colpitts oscillator, the tank circuit is made up of L_1, C_1 and C_2. The frequency of oscillations is determined by the values of L_1, C_1 and C_2, and is given by

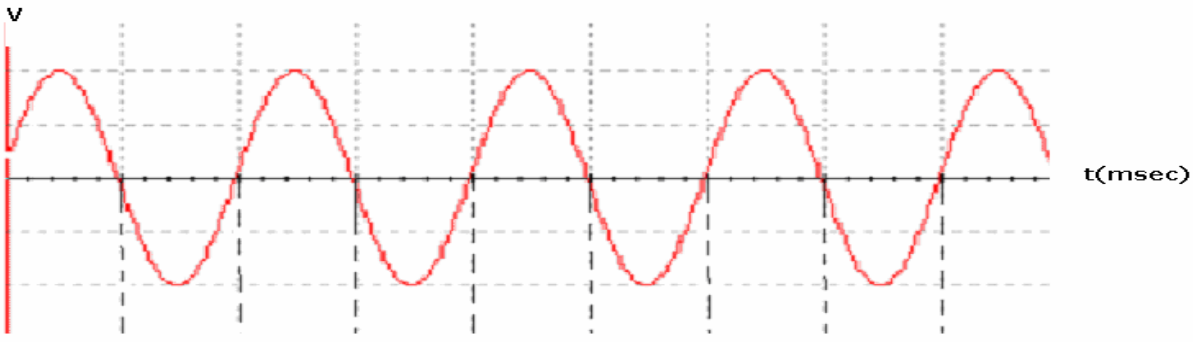


$$F = 1 / (2\pi (L^* C_T)^{1/2})$$

Where $C_T = C_1C_2 / (C_1 + C_2)$

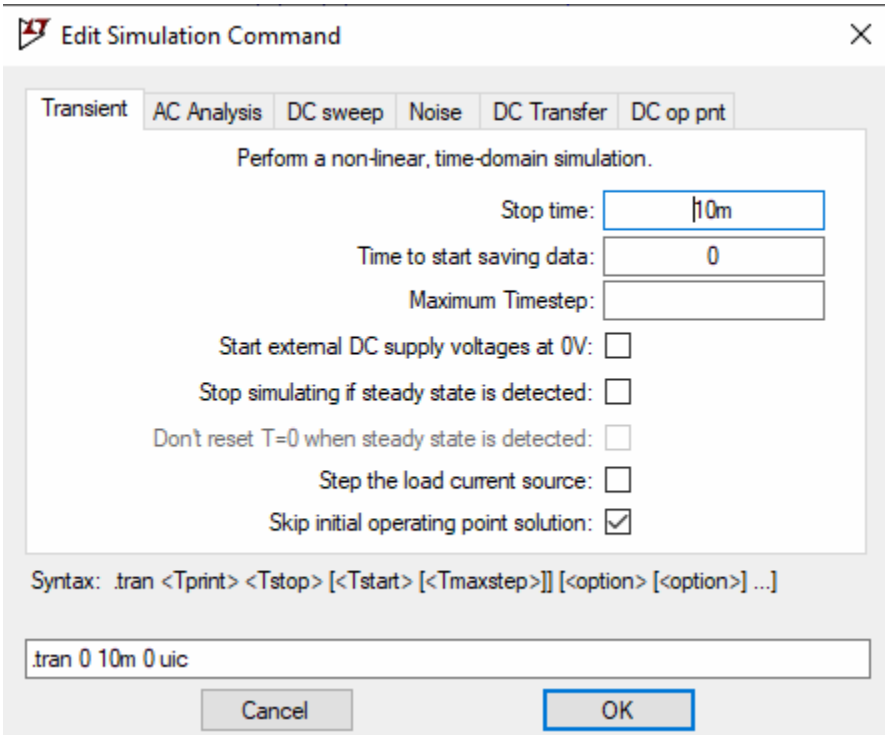
The energy supplied to the tank circuit is of correct phase. The tank circuit provides signal which is 180^0 out of phase. Also the op-amp is connected as an inverting amplifier with a high gain which provides another 180^0. In this way, energy feedback to the tank circuit is in phase with the generated oscillations.

Model Waveform:



Experiment Procedure:

1) Open New Schematics, Use the components icon to enter the components menu and select a component/device. Place the component/device on your schematics
2) Place all the required component/device on your schematics, assign value and names by double click. Click on wire icon to connect the components.
3) Go to Stimulate; now click on Edit Simulation Cmd. Select Transient, set Stop Time 30 ms and Time to start saving data as 0 and enable skip initial operating point solution.



4) Save the schematics in the desired folder and click on Run icon to stimulate the circuit.
5) A new output window will pop out. Now click and click on Vout and select some time period to zoom in and observe the oscillations
6) Note the frequency of oscillation using with help of cursors. Left click on output trace to get the two cursors
7) Calculate the theoretical frequency of oscillation and compare it with practical frequency.
8) Repeat the above experiment with L = 20 mH

OBSERVATION:

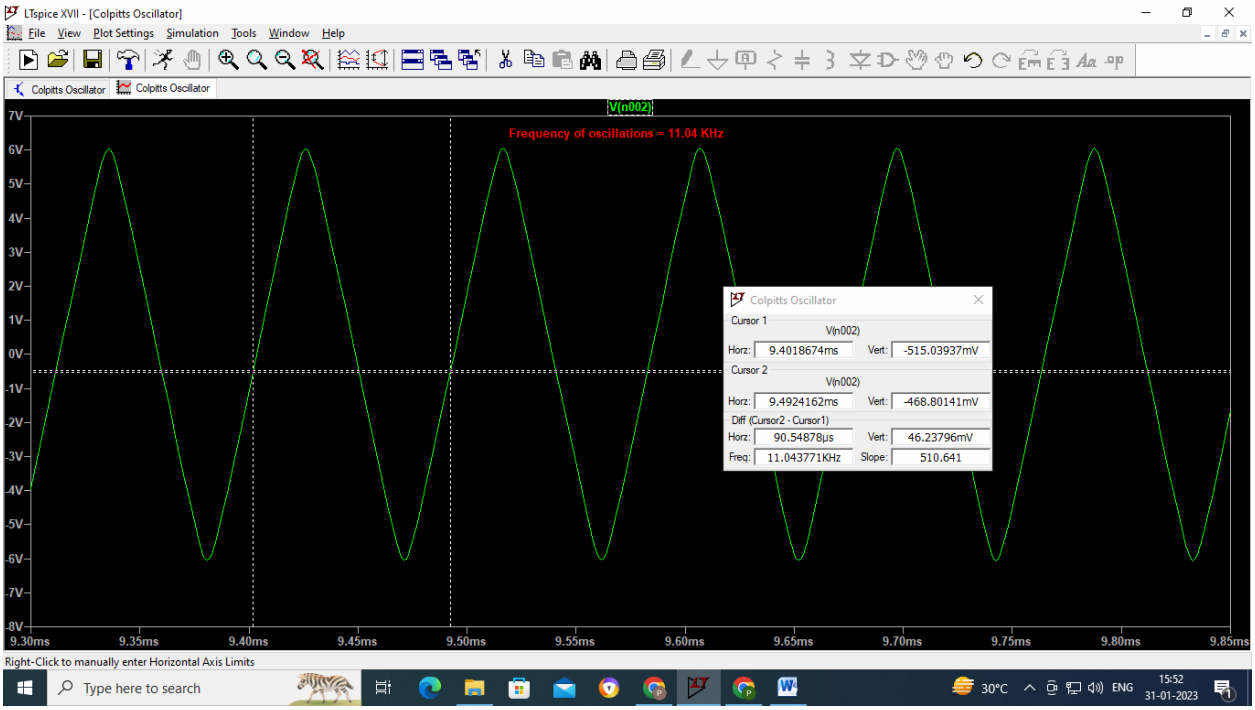
Sr. No.	Inductor	Theoretical Frequency	Practical Frequency
1	10 mH	11.253 KHz	11.043 KHz
2	20 mH	7.957 KHz	7.767 KHz

CONCLUSION:

Frequency of oscillations of Colpitts oscillator is measured practically and compared with theoretical values. The practical frequency matched with theoretical frequency.

Result:

1) **For L = 10 mH**



2) **For L = 20 mH**