EXPERIMENT-9

Objective:- Study of phase shift oscillator using op-amp.

Theory:-

Phase shift oscillator:-

A Phase Shift Oscillator is an electronic oscillator circuit which produces sine wave output. It can either be designed by using transistor or by using an Op-amp as inverting amplifier. Generally, these phase shift oscillators are used as audio oscillators.

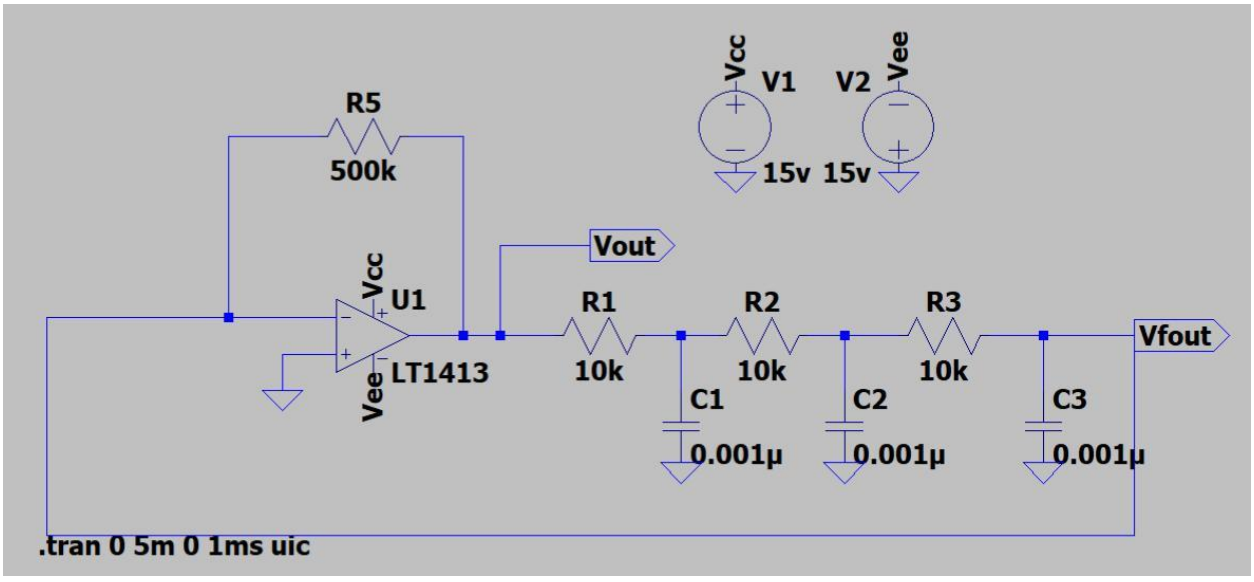
RC Phase shift oscillator:-

R-C phase shift oscillator using op-amp uses an op-amp in inverting amplifier mode. Thus it introduces the phase shift of 180° between input and output. The feedback network consists of 3 RC sections each producing 60° phase shift.

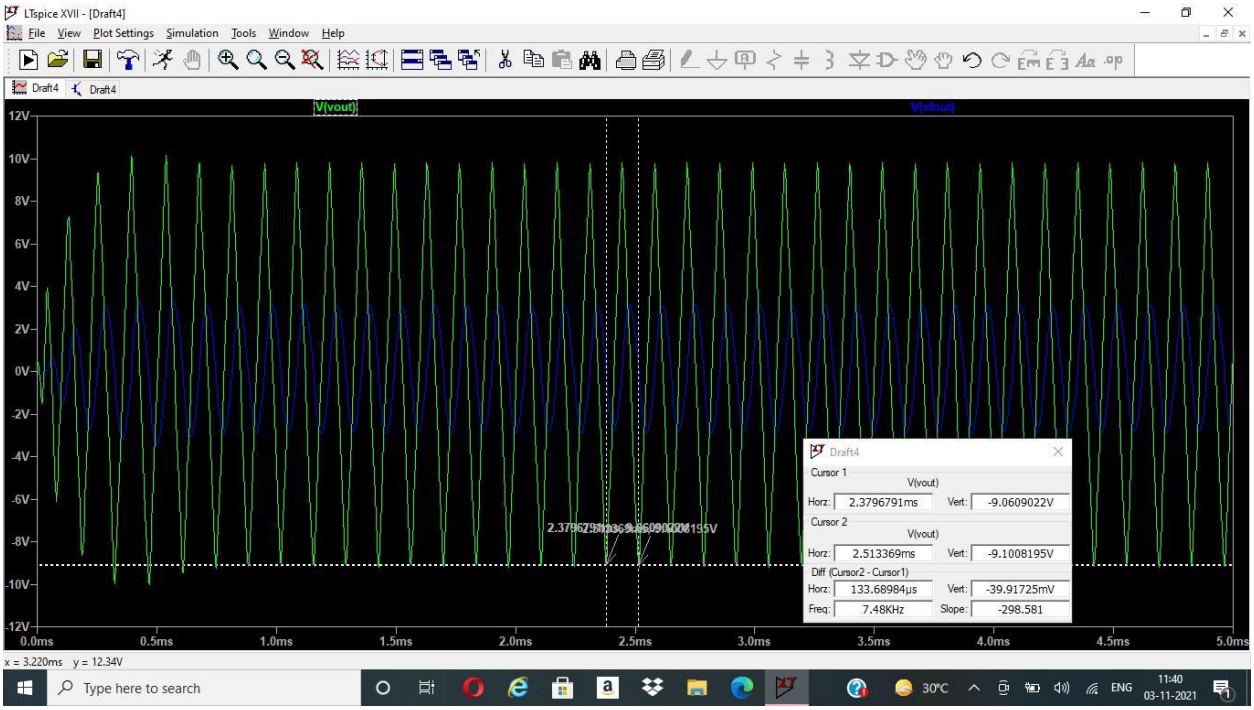
Working principle of RC Phase shift oscillator:-

The output of the amplifier is given to the feedback network. The output of the feedback network drives the amplifier. The total phase shift around a loop is 180° of the amplifier and 180° due to 3 RC section, thus 360°. This satisfies the required condition for positive feedback and circuit works as an oscillator. Thus circuit will work as an oscillator which will produce a sinusoidal waveform if the gain is 29 and total phase shift around a loop is 360°. This satisfies the Barkhausen criterion for the oscillator. These oscillators are used over the audio frequency range i.e. about 20 Hz up to 100 kHz.

Circuit diagram:-



Result:-



Observation:-

Theoretically:-

Here in the circuit diagram we can see that we have taken R as 10k-ohm and C as 0.001 microfarad. Here we are using 3 stage RC network so N=3. We know frequency at which the phase shift oscillator oscillates is given by the formula :-

$$f = 1/(2\pi \times RC \times \sqrt{2N})$$

$$f = 1/2\pi\sqrt{6}RC$$

Putting the value of R =10k and C=0.001uF,we get:-

$$f = 6.49 \text{ khz}$$

Practically:-

From the graph we can see

time period (T)= 133.689 us.

Frequency= 1/T

= 1/133.689 us

= 7.48 khz

Discussion:-

So theoretically the frequency at which the phase shift oscillator oscillates is coming around 6.49khz(approx 6.5khz) and practically from the graph it is coming around 7.48 khz. The advantages of R-C phase shift oscillator are:-

I)The circuit is simple to design.

ii)Can produce output over the audio frequency range.

iii)Produces sinusoidal output waveform.

iv)It is a fixed-frequency oscillator.