RC-PHASE SHIFT OSCILLATOR

Aim:

1. To study the operation of RC-Phase Shift Oscillator using BJT.
2. To verify Barkhausen's Phase criterion.

Apparatus:

Sl. No	Name of the component	Specifications or range	Quantity
1	Transistors	BC547 or BC548	1
2	Resistors	33KΩ,1KΩ,4.7KΩ, , 6.8KΩ,	1,1,3,2
3	Capacitors	10µF,100µF ,1KPF	2,2,3
4	CRO	20MHz	1
5	Function generator	2MHz	1
6	Regulated power supply	(0-30)V,1A	1
7	Connecting wires and probes	-----	Required no

Theory:

An Oscillator is an electronic circuit that provides an A.C output (Oscillations) without using any external input. All sinusoidal oscillators use the concept of positive feedback to produce Oscillations. An Oscillator circuit must satisfy Barkhausen's criterion to produce oscillations.

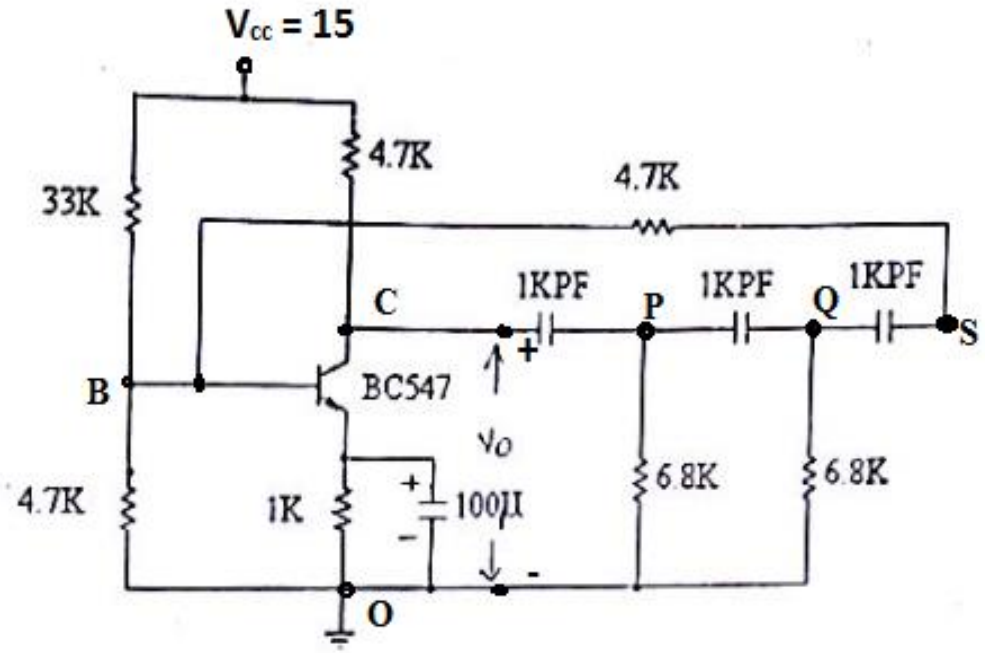
Barkhausen's criterion is divided into two criteria

i. Phase criterion : overall phase shift produced by the circuit must be a multiple of $2n\pi^o$ where n = 0,1,2,3,4……etc

ii. Magnitude criterion: loop gain of the circuit $|A\beta| \geq 1$

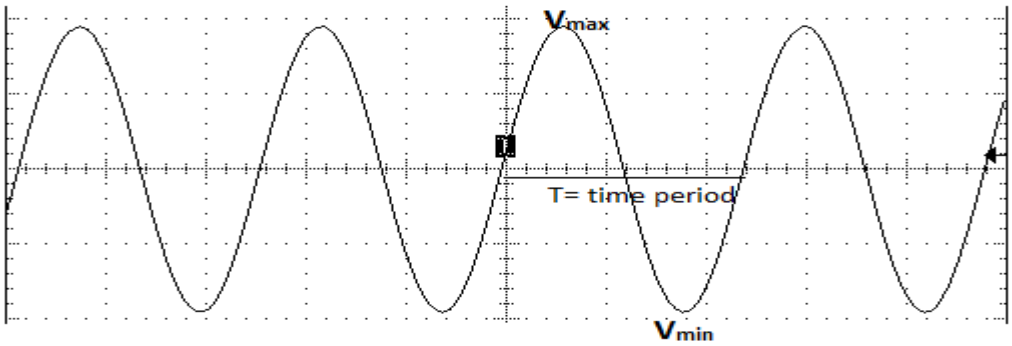
The common emitter amplifier provides a phase shift of 180^o. Additional 180^o of phase shift is provided by feedback network (3 RC-sections) to satisfy the condition required for oscillations. RC phase shift oscillators are used at Audio frequencies (20Hz to 20 KHz).

Circuit Diagram:



RC Phase Shift Oscillator

Model graphs:



Oscillator output

Experimental procedure:

1. Connections are made as per biasing circuit diagram and check the D.C conditions.
2. Connect the circuit diagram as shown in the oscillator .Observe the peak to peak output voltage and time period of the output waveform. Calculate the frequency of oscillation using f= 1/T) Hz.

Verification of Barkhausen's Phase criterion:

1. Check the phase difference of 180^o between **input** (Connect CH1 of CRO between Base (B) & GND (O)) and **output** (Connect CH2 of CRO between Collector(C) & GND) of Transistor circuit.
2. Check the Phase difference of feedback RC-Network.

   First RC-network:

   Measure Phase difference b/w **input (**CH1- CO) and **output** CH2-PO).

   Second RC-network:

   Measure Phase difference b/w **input (**CH1- PO) and **output** CH2-QO).

   Third RC-network:

   Measure Phase difference b/w **input (**CH1- QO) and **output** CH2-SO).
3. Now calculate Overall phase shift provided by Oscillator

   Total Phase shift =Phase shift provided by Transistor circuit + Phase shift provided by feedback network (3 RC-sections).

   Total phase shift must be 360^o.

Observations:

Sl.No	Theoretical values	Practical values
1	$f_{theoritical} = \frac{1}{2\pi\ R\ C\ \sqrt{(6+4\frac{R_C}{R})}}$ $R_c = 4.7K\Omega$, R = 6.8KΩ and C= 1KPF	
2.	Overall phase shift= 360^o	

Precautions:

1. All connections must be done carefully.
2. Switch off power supply before making connections.

Result: Thus RC phase shift oscillator was designed and the frequency of oscillation as obtained practically.