Experiment #11 Wein Bridge Oscillator

Objective
To study and implement wein bridge oscillator

Equipment
Zener Diode
DMM
Capacitor
Oscilloscope\ with Probes
Trainer IT-2007
Resistor

Theory

The oscillator is a circuit that produces a periodic waveform on its output with only DC supply voltage as an input. The output voltages may be sinusoidal or non-sinusoidal. Oscillators are classified into two types,

1. Feedback oscillators
2. Relaxation oscillators

Feedback oscillators return a fraction of output signal to input with no net phase shift resulting a reinforcement of output signal. When bridge is an example of feedback oscillators.

Wein bridge oscillator

An oscillator which uses RC lead-lag circuits instead of LC conventional tuned tank circuit to produce sinusoidal output waveform is known as wein bridge oscillator.
It is called a bridge circuit because its circuit is based on frequency selective form of Wheatstone bridge circuit. The wein bridge oscillator is two stage RC coupled amplifier circuit that has good quality stability at resonant frequency.

Phase delay or advancement

Wein bridge oscillator uses a feedback circuit consisting of series RC circuit connected with parallel RC circuit of same component value producing a phase delay or phase advance circuit depending on frequency

Working
At low frequencies the X_L of series capacitor is very high so it acts like an open circuit blocking any input signal and resulting in no output signal likewise at high frequency, the X_c of parallel capacitor is very low so this parallel connected circuit act as short circuit across output so again there is no output signal. So there must be a point where Vo reaches its maximum value. The frequency value of input waveform at which this happen is called oscillator resonant frequency. At this frequency from the circuit reactance becomes equal to resistance and phase difference

between input and output becomes zero. The magnitude of output voltage is therefore at its maximum and is equal to 1/3 of input voltage.

$$A_v = \frac{V_o}{V_{in}} = \frac{1}{3} \qquad (11.1)$$

Wein Bridge Oscillator frequency

The resonant frequency of oscillator is given as

$$f_c = \frac{1}{2\pi RC} \qquad (11.2)$$

Where,

fc is Resonant frequency, R is resistance and C is capacitance

Circuit Diagram

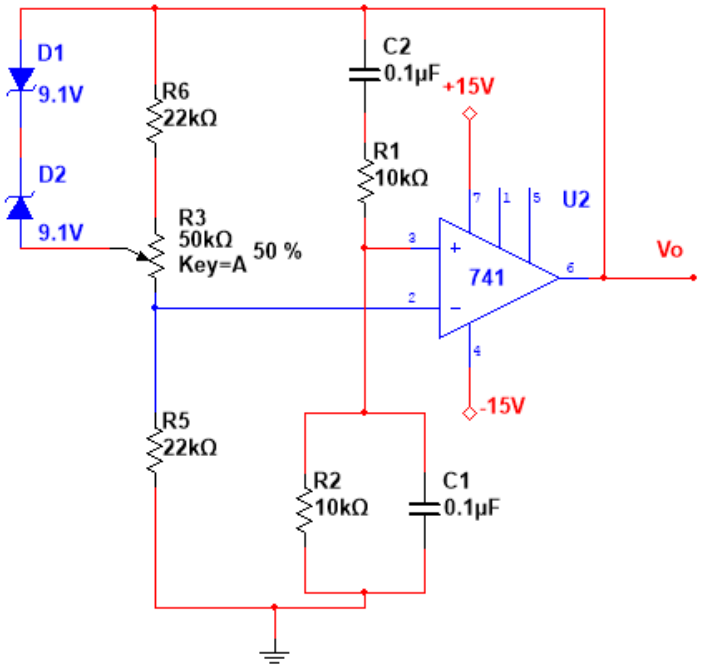

Figure 11.1: Wein Bridge Oscillator

Procedure

1. Connect circuit diagram according to given circuit shown in Figure 11.1.
2. Adjust oscilloscope as, CH1 For input and CH2 for output.
3. Using channel 2 of oscilloscope measure output voltages of circuit. Adjust R4 gradually until the sine wave at output of circuit is oscillated. Adjust R4 until sine wave reaches 20Vp-p.
4. Record the output voltage's (Vo) waveform.

5. Changes values of R1 and R2 to be 5KHz and observe output voltage waveform.
6. Change R1 and R2 to be 2.5 K-ohm and observe waveform.
7. Read frequency of output signal from all three waveform.
8. Calculate the resonance frequency fr by using (11.2).

Observations

Input Voltages(V)	$R1=R_L$	Theoretical Value f(Hz)	Practical Values f(Hz)

Lab Task

1. Put R1 and R2 to be 20k-ohm and observe and calculate fr?

Conclusion