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| **Course Name:** | **Linear Integrated Circuits and Design** | **Semester:** | **V** |
| **Date of Performance:** |  | **Batch No:** | **B1** |
| **Faculty Name:** | **Prof. Milind Marathe** | **Roll No:** | **1912052** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **/25** |

**Experiment No: 8**

**Title: To design and implement Wein Bridge Oscillator**

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| **Aim and Objective of the Experiment:** |
| * To design and implement Wein Bridge Oscillator using opamp |

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| **COs to be achieved:** |
| **CO4:** Study internal functional blocks and design some applications of special ICs like Timers,  Regulator circuits, PLL, ADCs and other ICs. |

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| **Theory:** |
| Wien bridge oscillator is an audio frequency sine wave oscillator of high stability and simplicity. The feedback signal in this circuit is connected to the non-inverting input terminal so that the op-amp is working as a non-inverting amplifier. Therefore, the feedback network need not provide any phase shift.  The circuit can be viewed as a Wien bridge with a series combination of R1 and C1 in one arm and parallel combination of R2 and C2 in the adjoining arm. Resistors R3 and R4 are connected in the remaining two arms. The condition of zero phase shift around the circuit is achieved by balancing the bridge. The series and parallel combination of RC network form a lead-lag circuit. At high frequencies, the reactance of capacitor C1 and C2 approaches zero. This causes C1 and C2 appears short. Here, capacitor C2 shorts the resistor R2. Hence, the output voltage Vo will be zero since output is taken across R2 and C2 combination. So, at high frequencies, circuit acts as a 'lag circuit'.  At low frequencies, both capacitors act as open because capacitor offers very high reactance. Again, output voltage will be zero because the input signal is dropped across the R1 and C1 combination. Here, the circuit acts like a 'lead circuit'. But at one particular frequency between the two extremes, the output voltage reaches to the maximum value. At this frequency only, resistance value becomes equal to capacitive reactance and gives maximum output. Hence, this frequency is known as oscillating frequency (f). |

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| **Circuit Diagram:** |
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| **Stepwise-Procedure:** |
| 1. Make the connections as per diagram. 2. Observe the output waveform. 3. Measure the frequency of the output waveform practically. 4. Verify theoretical and simulated values of frequency. |

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| **Observation Table:** |
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| **Calculation:** |
| **Design:-** Design Wein bridge oscillator for the frequency of 1KHz  Assume  EMA_1605873602984 |

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| **Waveforms:** |
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| **Post Lab Questions:** |
| 1. State the two conditions of oscillations?   Ans:- To start the oscillation with the constant amplitude, positive feedback is not the only sufficient condition. Oscillator circuit must satisfy the following two conditions known as Barkhausen conditions:  1. The first condition is that the magnitude of the loop gain (Aβ) must be unity. This means the product of gain of amplifier 'A' and the gain of feedback network 'β' has to be unity.  2. The second condition is that the phase shift around the loop must be 360° or 0°. This means, the phase shift through the amplifier and feedback network has to be 360° or 0°. Let us consider the basic requirement of oscillator circuit. First, amplification is required to provide the necessary gain for the signal. Second, sufficient regenerative feedback is required to sustain oscillations. Third, a frequency determining device is needed to maintain the desired output frequency. Generally, the Barkhausen criteria has two conditions, first the closed-loop gain is equal to 1, second the closed-loop phase is equal to 0, with these conditions, the oscillator circuit would generate a sinusoidal signal.   1. Derive the gain and frequency for RC phase shift oscillator?   Ans:-    Let us find the transfer function of the RC feedback network :  osc11  Applying KVL to various loops we get,  osc12  Replacing jω by s and writing the equations in the matrix form,  osc13  Using the Crammer’s rule to obtain I3  osc14  osc15  osc16  osc17  This is the frequency with which circuit oscillates,  At this frequency,  osc18  The negative sign indicates a phase shift of **180°**   1. Set up Wein bridge oscillator circuit in LTspice with amplitude gain Stabilization? |

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| **Conclusion:** |
| We have successfully implemented and observed the working of Wein bridge Oscillator |

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| **Signature of faculty in-charge with Date:** |