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| **Course Name:** | **Electronic Circuits Analysis and Design** | **Semester:** | **IV** |
| **Date of Performance:** | **1/03/2021** | **Batch No:** | **B2** |
| **Faculty Name:** | **Prof. Sonia** | **Roll No:** | **1912052** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **/25** |

**Experiment No: 6**

**Title: To study low frequency Wein Bridge Oscillator**

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| **Aim and Objective of the Experiment: Implementation of low frequency Wein Bridge Oscillator** |
| 1) To calculate the frequency of the Oscillator  . |

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| **COs to be achieved:** |
| CO 3. Understand the concept of feedback and apply it to amplifiers and oscillators |

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| **Theory:** |
| To generate a audio frequency(low frequency) one oscillator called Wien bridge oscillator circuit is used. This is mostly used because of its important features. This circuit is free from the circuit fluctuations and the ambient temperature.  The main advantage of this oscillator is that the frequency can be varied in the range of 10Hz to about 1MHz whereas in RC oscillators, the frequency is not varied.  The circuit of Wien bridge oscillator can be explained as given below. It is a two-stage amplifier with RC bridge circuit. The bridge circuit has the arms R1C1, R3, R2C2 and the R4. Resistance R3 and the R4 are used to stabilize the amplitude of the output  The transistor T1 serves as an oscillator and an amplifier while the other transistor T2 serves as an inverter. The inverter operation provides a phase shift of 180o. This circuit provides positive feedback through R1C1, C2R2 to the transistor T1 and negative feedback through the voltage divider to the input of transistor T2.  The frequency of oscillations is determined by the series element R1C1 and parallel element R2C2 of the bridge. |

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| **Circuit Diagram:** |
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| **Stepwise-Procedure:** |
| 1. Make the connections as per the Circuit diagram. 2. Select the transient response from Edit Simulation command 3. Calculate Frequency from the waveform 4. Measure the Amplitude of the sinusoidal waveform |

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| **Observation Table:** |
| |  |  | | --- | --- | | Wein Bridge’s oscillator | Observed values | | Time period of the output oscillations | 0.8098ms | | Frequency of oscillations | 1.2348928KHz | | Amplitude of output oscillations | 4.4130478V |   Tabular Results (should include the comparison of theoretical and practical values)   |  |  |  | | --- | --- | --- | | Wein Bridge’s oscillator | Theoretical value | Observed value | | Frequency of oscillations | 1.539KHz | 1.2348928KHz | |

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| **Calculation:** |
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| **Waveform** |
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| **Post Lab Subjective/Objective type Questions:** |
| 1. Derive the Gain Expression for Wein Bridge Oscillator   enter image description here  Vf= (Zp )/((Zp+Zs))\*Vin…………………………………………..2  And β=Zp/((Zp+Zs))……………………………………………….3  Lets obtained equations for Zp and Zs  Zs=R1+ 1/jwC1=(1+jwR1C1)/jwC1……………………………………………..4  And  Zp=R2IIXc2=R2II 1/( jwC2) =(R2\*(1/jwC2))/(R2+(1/jwC2) )= R2/((1+jwR2C2))…………..5  Substituting equation 4and 5 in equation 3 we get  β=([R2/(1+jwR2C2)])/([1+jwR1C1/jwC1]+[R2/(1+jwR2C2)])  Substituting jw=s in above equation and solving for β we get  β= ([R2/(1+sR2C2)])/([1+sR1C1/sC1]+[R2/(1+sR2C2)])  β=sC1R2/([(1+sR1C1)(1+sR2C2) ]+sR2C1)  =sC1R2/(1+s(R1C1+R2C2)+S^2 R1R2C1C2+SR2C1)  β= sC1R2/(1+s(R1C1+R2C2+R2C1)+s^2 R1C1R2C2)…………………6  Re substitute s = jw and s^2= j^2.w^2= -w^2 into equation 6  β= jwC1R2/ (1 +jw(R1C1+R2C2+R2C1)+s-w^2 R1C1R2C2)  β = jwC1R2/((1-w^2 R1R2C1C2)+jw(R1C1+R2C2+R2C1))………………………..7  Rationalize the equation 7 to get  β = (jwC1R2[(1-w^2 R1C1R2C2)-jw(R1C1+R2C2+R2C1)])/((1-w^2 R1C1R2C2)^2+w^2 (R1C1+R2C2+R2C1)^2 )……..8  As mentioned earlier, the phase shift introduced by wein bridge circuit at the desired output frequency should be 0^°.For that the imaginary part of equation 8 should have a zero value.  wC1R2[(1-w^2 R1C1R2C2) =0  Therefore w^2 R1C1R2C2 =1  or w^2=1/R1C1R2C2  w = 1/√(R1C1 R2C2)  And frequency f = 1/(2π√(R1C1 R2C2))  **Oscillator frequency f = 1/2πRC**  Feedback factor β = (w^2 CR(3RC)+jwCR(1-w^2 R^2 c^2))/((1-w^2 R^2 c^2)^2+w^2 (3RC)^2 )  Now substitute w =1/RC in above equation we get,  β = 3/(0+〖1/(C^2 R^2 )(3RC)〗^2 )=3/9  **β =1/3**   1. Explain the classification of Oscillators.   These classifications types have been given below:   1. Classification Based on the Feedback Mechanism: Positive Feedback Oscillators and Negative Feedback Oscillators. 2. Classification Based on the Shape of the Output Waveform: Sine Wave Oscillators, Square or Rectangular Wave oscillators, Sweep Oscillators (which produce saw-tooth output waveform), etc. 3. Classification Based on the Frequency of the Output Signal: Low-Frequency Oscillators, Audio Oscillators (whose output frequency is of audio range), Radio Frequency Oscillators, High-Frequency Oscillators, Very High-Frequency Oscillators, Ultra High-Frequency Oscillators, etc. 4. Classification Based on the type of the Frequency Control Used: RC Oscillators, LC Oscillators, Crystal Oscillators (which use a quartz crystal to result in a frequency stabilized output waveform), etc. 5. Classification Based on the Nature of the Frequency of Output Waveform: Fixed Frequency Oscillators and Variable or Tunable Frequency Oscillators. 6. The Wein bridge oscillators uses 7. Both the negative and positive feedbacks 8. Positive feedback only 9. Negative feedback only 10. None of the above 11. Which of the following statements is correct regarding the Wien-bridge oscillator? 12. It is also called sine-cosine oscillator 13. It is a square wave generator 14. It is a free-running oscillator 15. It is a stable sine-wave audio generator |

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| **Conclusion:** |
| We applied feedback to the oscillator and found the frequency. |

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