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| **Course Name:** | **Electronic Circuits Analysis and Design** | **Semester:** | **IV** |
| **Date of Performance:** | **05/04/2021** | **Batch No:** | **B2** |
| **Faculty Name:** | **Prof. Sonia Joshi** | **Roll No:** | **1912052** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **/25** |

**Experiment No: 9**

**Title: To study Differential Amplifier**

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| **Aim and Objective of the Experiment:**  **Implementation of Differential Amplifier in different modes (DIBO/DIUO)** |
| 1. To Implement the Differential Amplifier in DIBO and DIUO 2. Calculate the Differential Gain in DIBO/DIUO 3. Calculate the Common Mode Gain (Acm) and CMRR   . |

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| **COs to be achieved:** |
| CO 3. Understand the need of Power Amplifiers and Differential Amplifiers |

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| **Theory:** |
| **Theory:**  The amplifier which amplifies the difference between input signals is called as differential amplifier. It is an extremely popular connection used in IC units. The circuit has two separate inputs 2 separate amplifiers and the input coupling from one amplifier to other.  Basic Characteristics  1) Two matched transistor with emitters shorted together and connected to the current source  2) Devices must always be in active mode  3) Amplifies the difference between the two input voltages, but there is also a common mode amplification in the non ideal case.  The different configurations that can be obtained are:  a) Single i/p balanced o/p. b) Single i/p unbalanced o/p.  c) Dual i/p balanced o/p. d) Dual i/p unbalanced o/p  If an i/p signal is applied to one of the i/ps with second input grounded, the operationis referred as single i/p. If twe out of phase signals are applied to two i/p,the operation is referred as dual i/p.  If the i/p is taken across one of the collector and ground, it is referred as unbalanced o/p and if the o/p is taken between two collectors, it is referred as balanced o/p.  In common mode operation, the common i/p signals results in opposites signals at each collector cancelling each other so that resulting i/p signal is zero. The main feature of differential amplifier is very large gain when opposite signals applied to i/p as compared to very low gain resulting from common i/p signals. |

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| **Circuit Diagram:** |
| Differential Amplifier for Differntial gain |

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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 5. Observe the Cross over distortion |

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| **Observation Table:** |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Configuration** | **Vin** | **Vout** | **Ad**  **(Observed)** | **Acm**  **(Observed)** | **CMRR**  **(in dB)** | | **DIBO** | **40mV** | **6.143V** | **153.57** | **1.05** | **43.302** | | **DIUO** | **80mV** | **6.107V** | **76.33** | **1.03** | **37.397** |   Tabular Results (should include the comparison of theoretical and practically observed values)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Configuration** | **Ad**  **(Observed)** | **Ad**  **(Theoretical)** | **Acm**  **(Observed)** | **Acm**  **(Theoretical)** | **CMRR**  **(in dB)**  **(Observed)** | **CMRR**  **(in dB)**  **(Theoretical)** | | **DIBO** | **153.57** | **94.71** | **1.05** | **0.53** | **43.302** | **45.09** | | **DIUO** | **76.33** | **47.35** | **1.03** | **0.5319** | **37.397** | **38.989** |   i) Keeping all other parameters same, only change Rs to a new value of 33K in the schematic & comment on CMRR value   |  |  |  | | --- | --- | --- | | **Parameter** | **CMRR in dB** | **CMRR in dB** | |  | **DIBO** | **DIUO** | | **RE = 20K** | **43.558** | **37.590** | | **RE = 33K** | **43.579** | **37.650** |   ii) Keeping all other parameters same, only change RD1 = RD2 to a new value of 20K in the schematic & comment on CMRR value   |  |  |  | | --- | --- | --- | | **Parameter** | **CMRR in dB** | **CMRR in dB** | |  | **DIBO** | **DIUO** | | **RC1 = RC2 = 25K** | **-25.02** | **-30.998** | | **RC1 = RC2 = 20K** | **-20.501** | **-26.5322** | |

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| **Calculation:** |
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| **Waveform** |
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| **Post Lab Subjective/Objective type Questions:** |
| 1. A differential amplifier has a differential gain of 20,000. CMRR=80dB. The common mode gain is given by  (a) 2 (b) 1 (c)1/2 (d) 0  **ANS: (a) 2** 2. A change in the value of emitter resistance (RE) in difference amplifier(a) Effects the difference mode gain Ad(b) Effects the common mode gain Ac(c) Effects both Ad and Ac.(d) does not either Ad  and AcAns: (b) Effects the common mode gain Ac 3. Derive the expression for Common Mode gain  4. What is Slew Rate? |

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| **Conclusion:** |
| In this experiment, we learnt about differential amplifiers. We simulated the circuit using Ltspice and determined CMRR for DIBO and DIUO. |

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