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| **Course Name:** | **Basic Electronic Circuits** | **Semester:** | **III** |
| **Date of Performance:** | **31/8** | **Batch No:** | **B2** |
| **Faculty Name:** | **Bharati maam** | **Roll No:** | **1912052** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **/25** |

**Experiment No: 4**

**Title: Zener diode as voltage regulator**

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| **Aim and Objective of the Experiment:** Study of Zener diode as voltage regulator |
| * To Study Application of Zener as Voltage regulator * Understand the concept of line and load regulation |

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| **COs to be achieved:** |
| **CO1:** **Analyze and design Diode circuits.** . |

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| **Theory:** |
| Zener diode is a special type of P-N junction diode, which when used in reverse bias, after the breakdown voltage provides constant o/p to the load. The doping level of the impurity added to manufacture zener diode is controlled in order to adjust the value of breakdown voltage.  **Working:**  As we increase the reverse voltage , initially a small reverse saturation current flows which is in uA. This current flows due to thermally generated minority carriers. At a certain value of reverse voltage the break down occurs, now the voltage across the zener remains constant irrespective of the change in the supply voltage. Any change in the source voltage will now result in increase in reverse zener current. The zener current after the breakdown must be controlled by connecting a resistor in series with the zener diode. This is to avoid in damage to the zener diode due to overheating.  After reverse breakdown, the zener diode operates in a region called as zener region. In this region the voltage across the Zener diode remains constant but the current changes depending on the supply voltage. Zener diode is operated in this region when it is being used as a voltage regulator. |

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| **Circuit Diagram/ Block Diagram:** |
| 1. **ZENER AS VOLTAGE REGULATOR (line regulation)**   `       1. **ZENER AS VOLTAGE REGULATOR (load regulation)** |

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| **Stepwise-Procedure:** |
| 1. Open a new Schematic. 2. Draw the Circuit As Shown. 3. For line regulation use .dc output statement and plot a graph. 4. For load regulation use .op output statement, vary R1 and observe the output voltage Vo. |

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| **Observation Table:** |

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| Line Regulation:   |  |  |  | | --- | --- | --- | | Sr. no | Vin | Vo | | 1 | 1 | 916.48828mV | | 2 | 2 | 1.8249877V | | 3 | 3 | 2.7325724V | | 4 | 4 | 3.6309432V | | 5 | 5 | 4.450501V | | 6 | 6 | 4.6561071V | | 7 | 7 | 4.6955567V | | 8 | 8 | 4.7182469V | | 9 | 9 | 4.7346344V | | 10 | 10 | 4.7478149V | | 11 | 11 | 4.75875V | | 12 | 12 | 4.7684061V | | 13 | 13 | 4.7770639V | | 14 | 14 | 4.7849666V | | 15 | 15 | 4.792275V |   Load Regulation:   |  |  |  | | --- | --- | --- | | Sr. no | RL | Vo | |  | 0 | 0 | |  | 10 Ω | 1.3636332V | |  | 20 Ω | 1.7137157V | |  | 40 Ω | 2.3954553V | |  | 50 Ω | 2.7271124V | |  | 500 Ω | 4.7888121V | |  | 1K Ω | 4.792275V | |  | 5K Ω | 4.7949789V | |  | 10K Ω | 4.7953076V | |  | 50k Ω | 4.7955704V | |  | 100K Ω | 4.7955947V | |  | 1M Ω | 4.7956033V | |

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| **Calculation:** |
| 1. Line regulation:  Calculated :  Observed:    **1.28571%**  2. Load regulation:  Calculated :    Observed:    = |

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| **Waveform** |
| 1. Transfer characteristics for change in Vin  2. Draw graph showing change in output voltage with change in load resistance. |

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| **Post Lab Subjective/Objective type Questions: (hand written)** |
| 1. Find the current flowing through Zener diode, series and load resistance.      **V(v\_vedant): 20.8333 voltage**  **V(n001): 25 voltage**  **I(D1): -2.08433e-011 device\_current**  **I(R2): 0.00208333 device\_current**  **I(Rs): -0.00208333 device\_current**  **I(V1): -0.00208333 device\_current**   1. Construct a voltage regulator circuit using Zener diode, having the regulated power supply of 10 volt (maximum source voltage is 20 V). |

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| **Conclusion: (to be written in own words)** |
| WE STUDIED ABOUT  Zener as Voltage Regulator (Line Regulation)  Zener as Voltage Regulator (Load Regulation) |

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