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| **Course Name:** | **Electronic Circuits Analysis and Design** | **Semester:** | **IV** |
| **Date of Performance:** | **21-02-2021** | **Batch No:** | **B2** |
| **Faculty Name:** | **Prof. Sonia** | **Roll No:** | **1912052** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **/25** |

**Experiment No: 5**

**Title: To study the frequency response of a Cascode amplifier.**

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| **Aim and Objective of the Experiment:** To study the frequency response of a Cascode amplifier. |
| 1. To calculate dc operating point 2. To calculate Total gain , Individual stage gain 3. To calculate lower cut off frequency, higher cut off frequency and bandwidth from frequency response. |

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| **COs to be achieved:** |
| CO2: Understand the need of multistage amplifiers for strengthening the signal |

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| **Theory:** |
| The cascode is a universal technique for improving analog circuit performance, applicable to both vacuum tubes and transistors. The word "cascode" is a contraction of the phrase "cascade to cathode". The cascode is a two-stage amplifier composed of a transconductance amplifier followed by a current buffer. The cascode is often constructed from two transistors with one operating as a common emitter or common source and the other as a common base or common gate. The cascode improves input-output isolation as there is no direct coupling from the output to input. This eliminates the Miller effect and thus contributes to a much higher bandwidth.  **Advantages:** The cascode arrangement offers high gain, high slew rate, high stability, and high input impedance. The parts count is very low for a two-transistor circuit.  **Disadvantages:** The cascode circuit requires two transistors and requires a relatively high supply voltage. |

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| **Circuit Diagram:** |
| 1. Transient response        1. Frequency Response |

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| **Stepwise-Procedure:** |
| 1. Make the connections as per the Circuit diagram.  2. Apply the sinusoidal input signal to the circuit.  3 Observe transient response of the circuit  4. Apply AC signal at the input of the circuit  5. Observe the Frequency response of the circuit  6. Calculate maximum gain and lower cut off frequency, higher cut off frequency, bandwidth theoretically and practically. |

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| **Observation Table:** |
| **A.C. Analysis:**  **DC Analysis (operating point)**  **V(n002): 11.372 voltage**  **V(n004): 4.34966 voltage**  **V(n005): 3.66148 voltage**  **V(vin\_vedant): 0 voltage**  **V(n003): 10.6831 voltage**  **V(n001): 14.5604 voltage**  **V(vcc): 20 voltage**  **V(vout\_vedant): 1.45604e-013 voltage**  **Ic(Q2): 0.00362637 device\_current**  **Ib(Q2): 1.77775e-005 device\_current**  **Ie(Q2): -0.00364414 device\_current**  **Ic(Q1): 0.00364414 device\_current**  **Ib(Q1): 1.73313e-005 device\_current**  **Ie(Q1): -0.00366148 device\_current**  **I(C4): 2.91209e-037 device\_current**  **I(C3): 1.73986e-023 device\_current**  **I(Cb1): 1.1372e-016 device\_current**  **I(C2): -1.45604e-017 device\_current**  **I(C1): 3.66148e-017 device\_current**  **I(Cc1): 4.34966e-018 device\_current**  **I(Rl1): 1.45604e-017 device\_current**  **I(Rc1): 0.00362637 device\_current**  **I(R3): 0.00115041 device\_current**  **I(R2): 0.0011153 device\_current**  **I(Re1): 0.00366148 device\_current**  **I(R1): 0.00113263 device\_current**  **I(Vcc1): -0.00477677 device\_current**  **I(Vin1): 4.34966e-018 device\_current**  **AC Analysis**   |  |  |  | | --- | --- | --- | |  | **Voltage Gain** | **Observation** | | **Transistor Q1 in CE configuration** | **AV1 = Vo1 / Vin** |  | | **Transistor Q2 in CB configuration** | **AV2 = Vout / Vo1** |  |   **Frequency Response**   |  |  |  |  | | --- | --- | --- | --- | | **Frequency (Hz)** | **Vout (V)** | **AV** | **AV in dB** | | **50** | **-32.524158dB** | **7.475842dB** | **19.845935dB** | | **70** | **-28.081043dB** | **12.094159dB** | **23.15285dB** | | **100** | **-23.776956dB** | **16.223044dB** | **25.412922dB** | | **500** | **-12.978879dB** | **31.371501dB** | **30.77047dB** | | **1000** | **-2.9863563dB** | **37.114871dB** | **32.174591dB** | | **5k** | **4.0324242dB** | **44.011534dB** | **33.965691dB** | | **10k** | **4.6265915dB** | **44.620692dB** | **34.20056dB** | | **30k** | **4.8185222dB** | **44.817162dB** | **34.34245dB** | | **50k** | **4.8332754dB** | **44.833275dB** | **34.368603dB** | | **100k** | **4.8399163dB** | **44.839916dB** | **34.389207dB** | | **500k** | **4.8388621dB** | **44.838951dB** | **34.380321dB** | | **1M** | **4.8292406dB** | **44.829241dB** | **34.35278dB** | | **2M** | **4.7900938dB** | **44.790094dB** | **34.298001dB** | | **3M** | **4.7195006dB** | **44.722819dB** | **34.239093dB** | |

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| **Calculation:** |
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| **Waveform** |
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| **Post Lab Subjective/Objective type Questions:** |
| 1. Explain the difference between Cascade and Cascode Amplifier      1. Applications of Cascode Amplifier (Min 2 Application)   1)RF tuners  2)Vacuum tubes. |

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| **Conclusion:** |
| We studied frequency response of a Cascode amplifier.  And Calculated Total gain , Individual stage gain lower cut off frequency, higher cut off frequency and bandwidth from frequency response.  Found out that of multistage amplifiers are needed for strengthening the signal |

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