EE301:- Analog Circuits Course Project

Submitted To:- Dr. Mahendra Sakare

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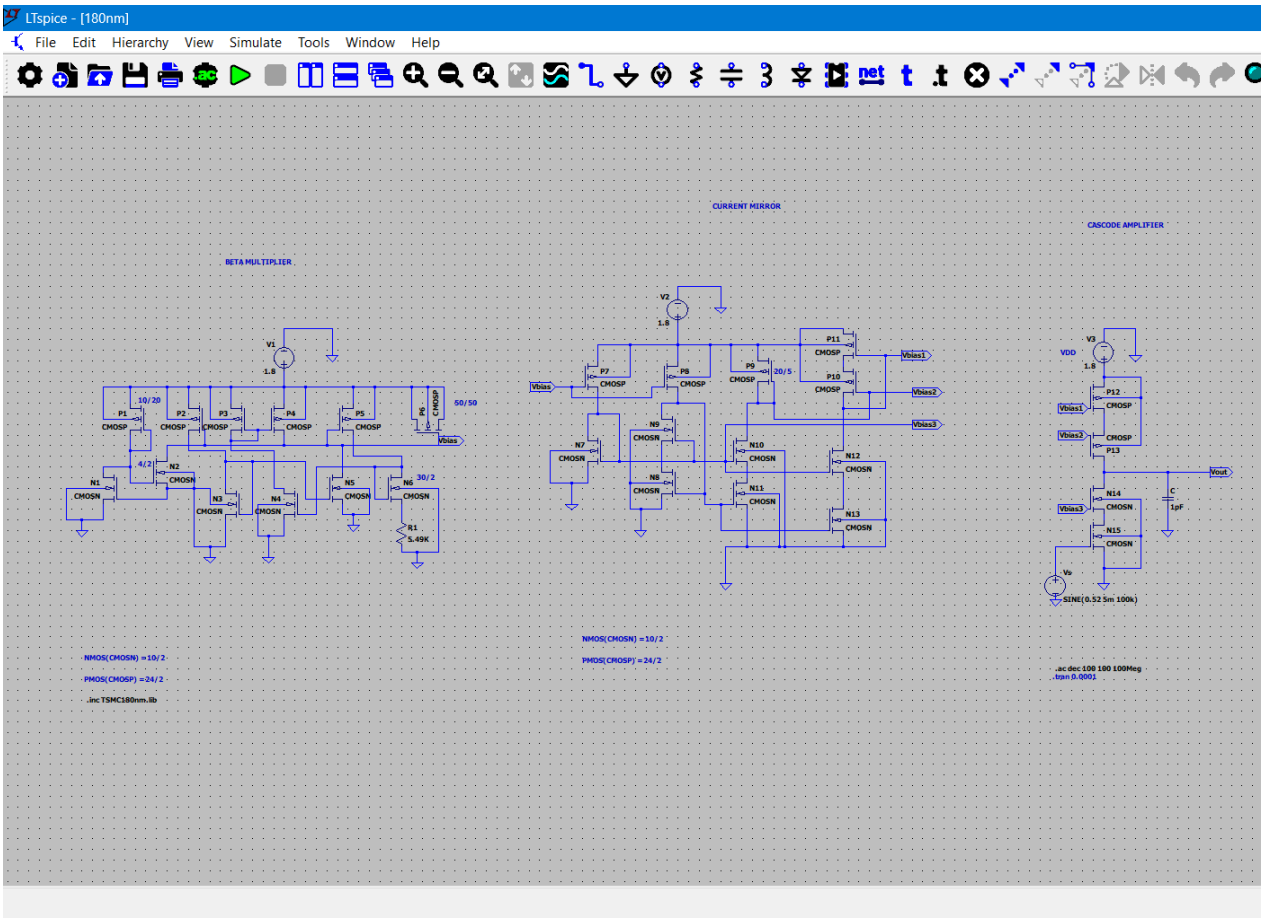
Objective:-

Design of cascode amplifier and cascode current mirror in schematic and layout using LTspice or Cadence and Magic/Cadence tools in 180 nm (supply 1.8 V) technology and only schematic of cascode amplifier, beta multiplier and cascode current mirror in 22 nm (supply 0.8 V) technology node to see the effect of lowering the technology node.

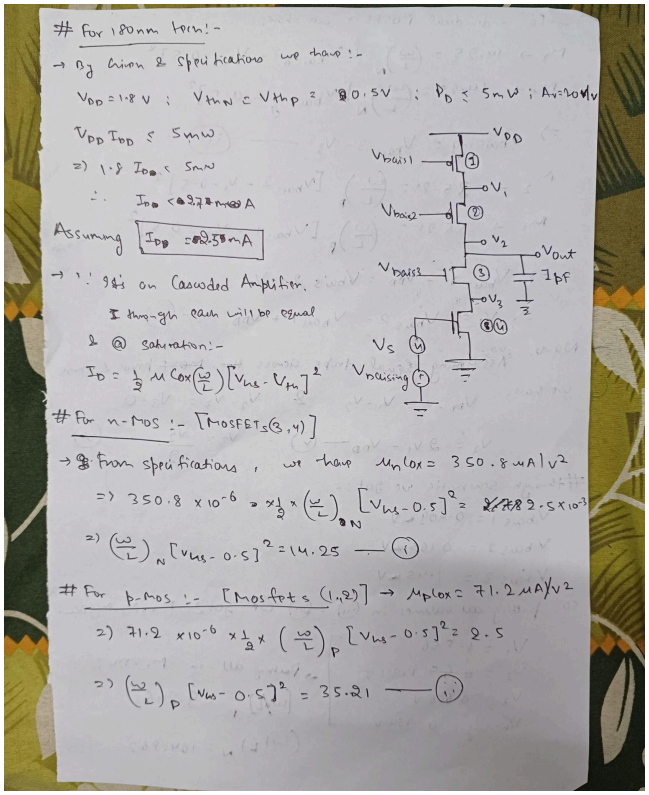
180nm technology schematics:-

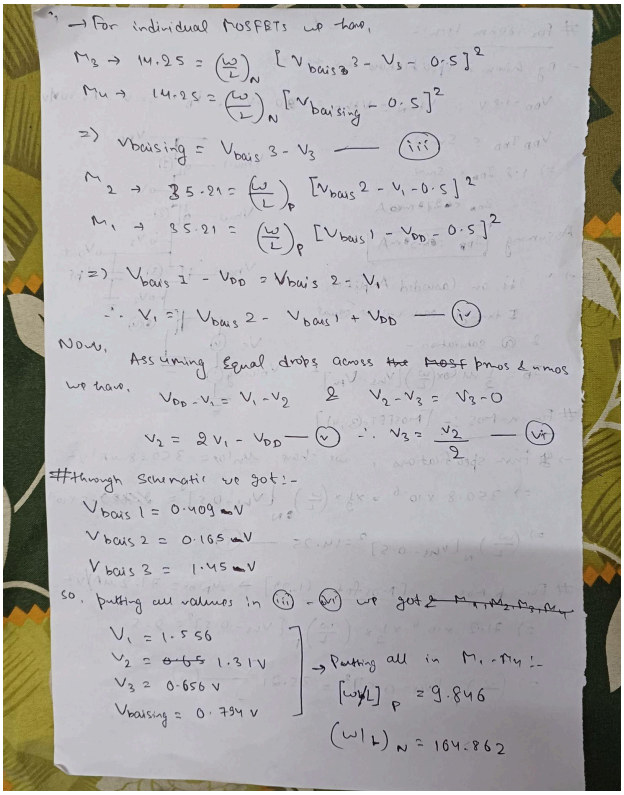


Given specifications to be followed and values obtained from spec file:-

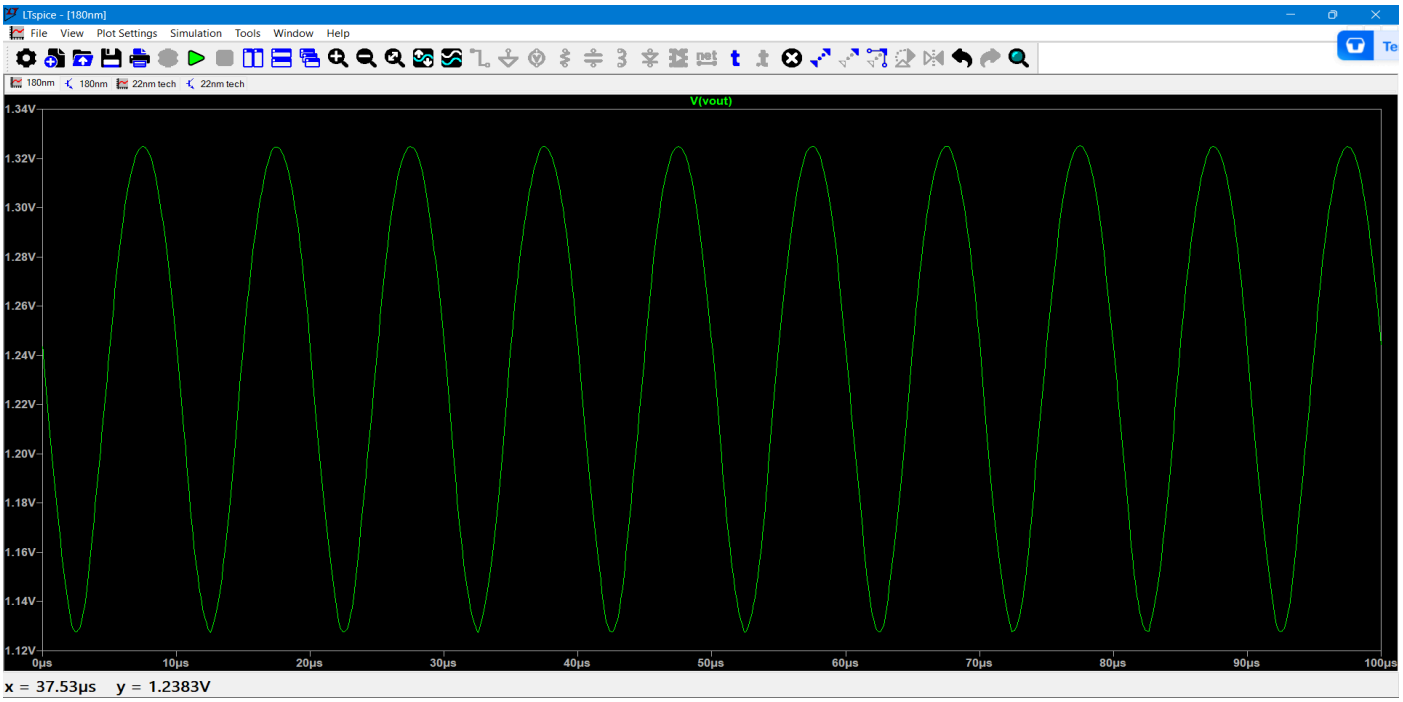
- VDD = 1.8 V
- A_v = 20 V/V = 26.02 dB
- Power dissipation (P_D) < 5 mW
- Load Capacitance (C_L) = 1 pF
- Unity Gain Bandwidth (UGB) > 500 KHz.
- $Vth_n = Vth_p$ = 0.5V
- $\mu_n C_{ox}$ = 350.8 $\mu A/V^2$
- $\mu_p C_{ox}$ = 71.2 $\mu A/V^2$

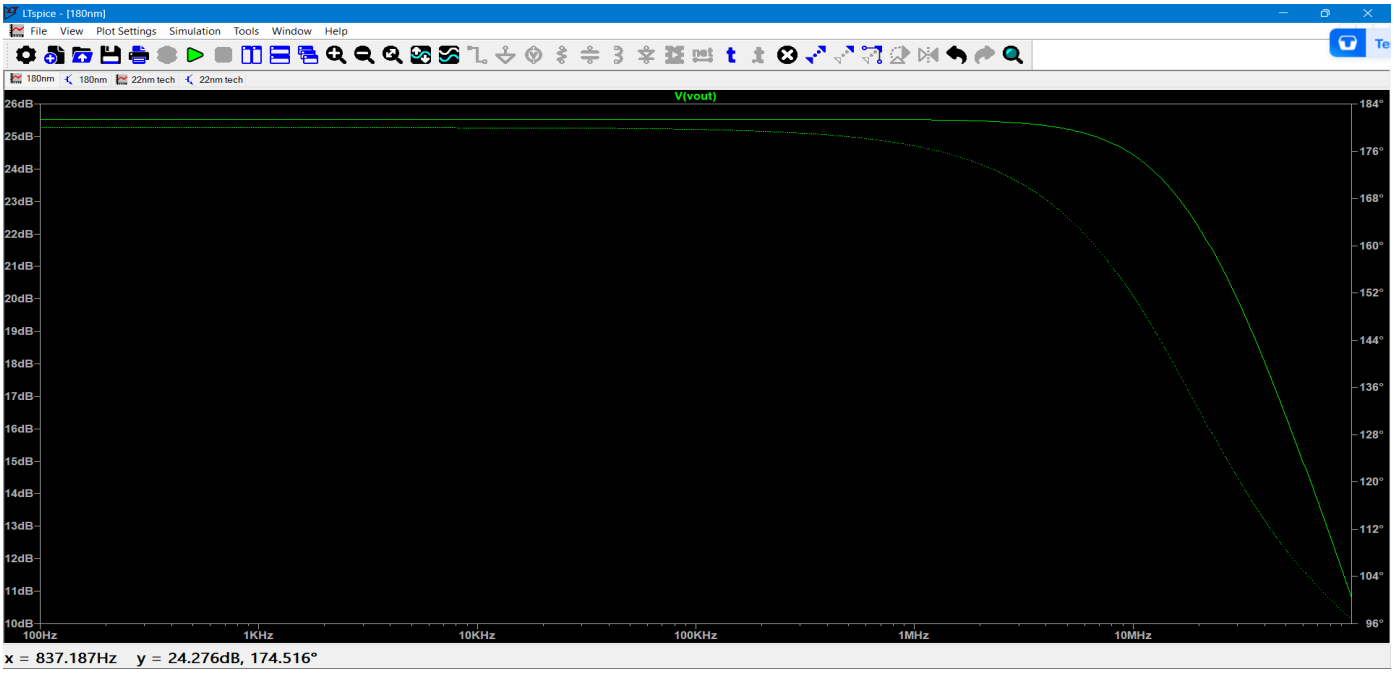
Calculations:-



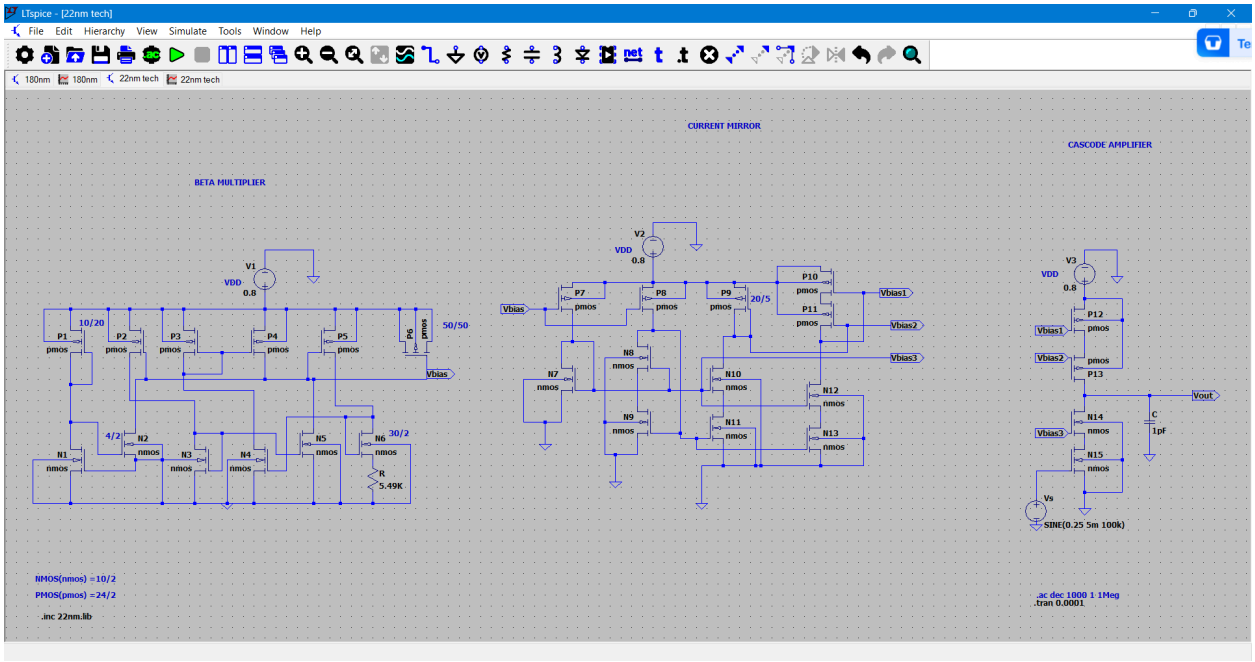


LTspice Plots - Vout And Gain:-





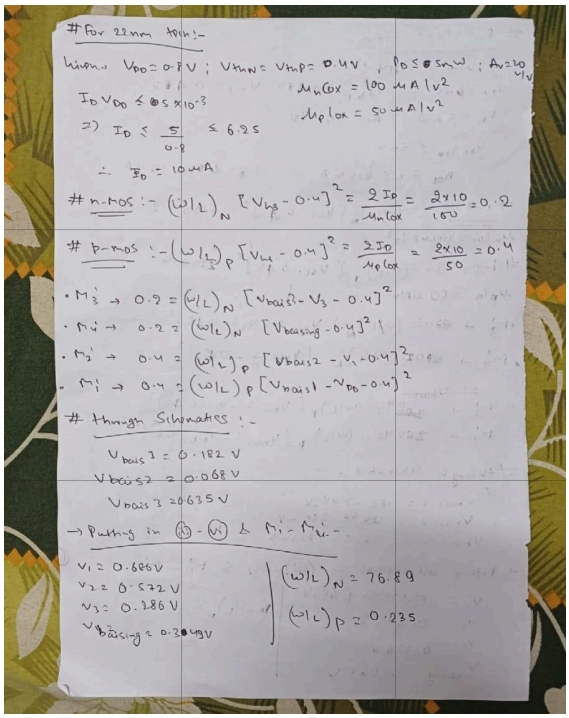
22nm technology schematics:-



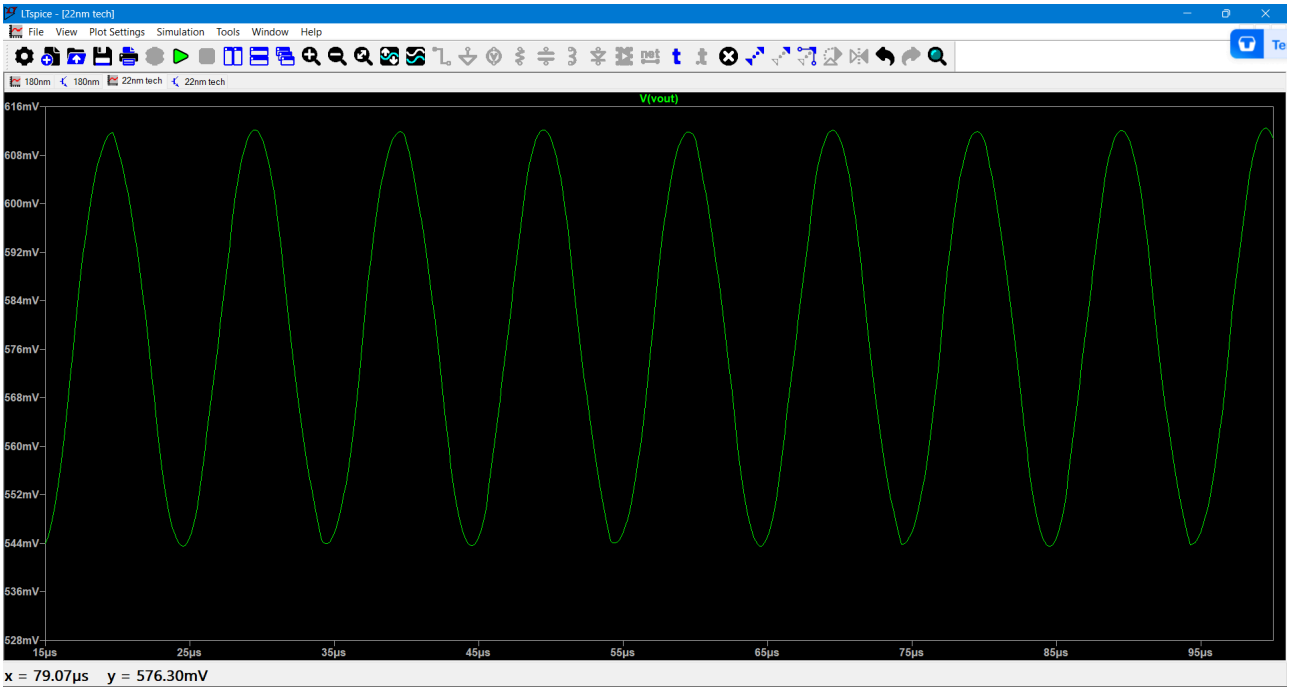
Given specifications to be followed and values obtained from spec file:-

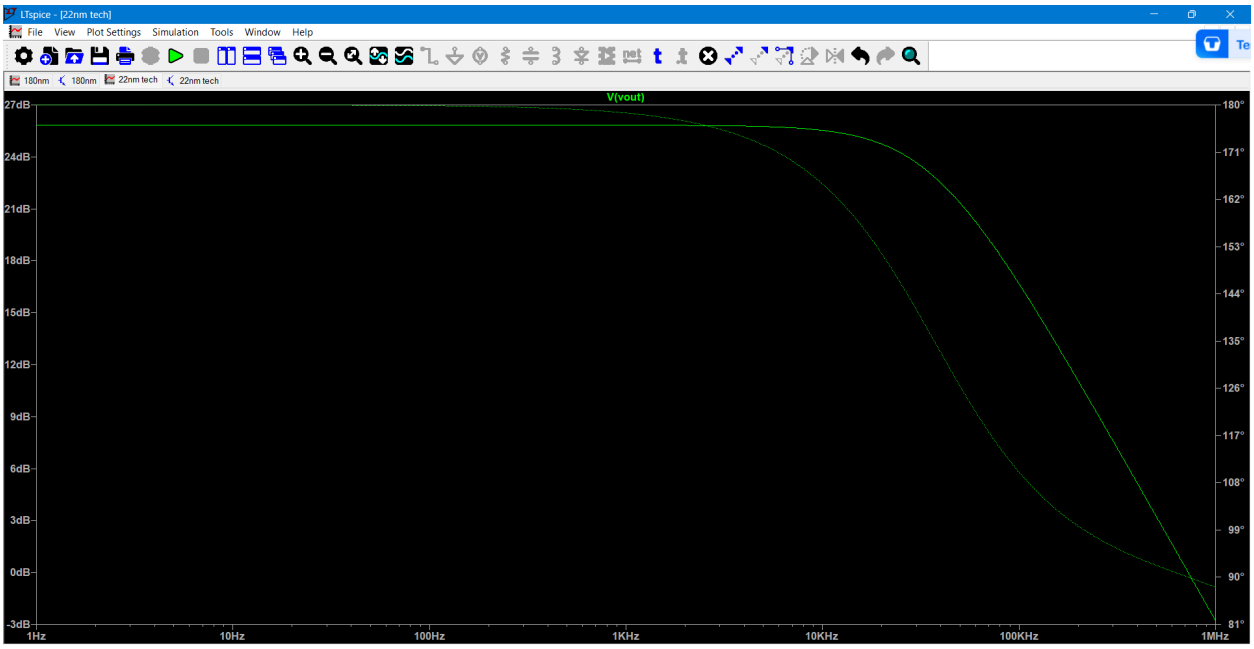
- VDD = 0.8 V
- A_V = 20 V/V = 26.02 dB
- Power dissipation (P_D) < 5 mW
- Load Capacitance (C_L) = 1 pF
- Unity Gain Bandwidth (UGB) > 500 KHz.
- $Vth_n = Vth_p = 0.3V$
- $\mu_n C_{ox} = 100\ \mu A/V^2$
- $\mu_p C_{ox} = 50\ \mu A/V^2$

Calculations:-

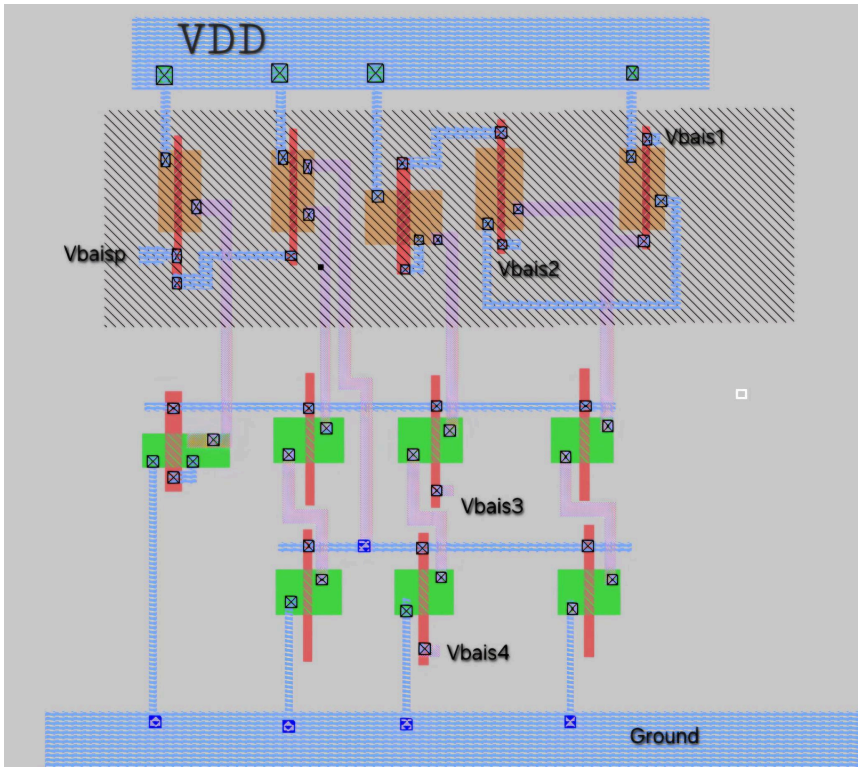


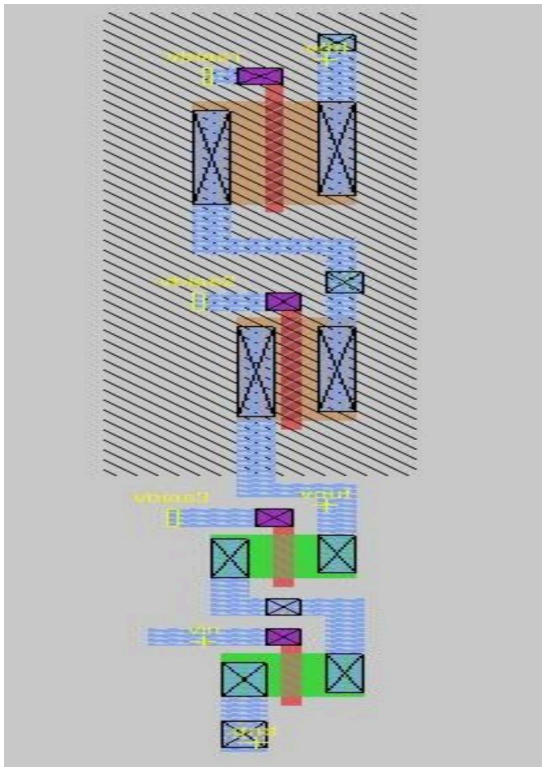
LTspice Vout and Gain plots:-





180nm Magic Layout:-





Results:-

Add tabulated results(calculated and practical) for both techhnologies containing values of all specified parameters. Results from ngspice simulations should be included as well.

Observations:-

- All simulated results thus obtained are under specified performance limits for both the technologies.
- Baising voltages for 180nm technology are greater than 22nm technology.
- Unity Gain Bandwidth for 180nm = 2MHz
- Unity Gain Bandwidth for 22nm = 350MHz
- Both technology's gain plots show that the given systems are low pass filters.

Conclusions:-

We conducted simulations of the Beta Multiplier, Cascode Current Mirror, and Cascode Amplifier circuits in LTspice for both 180nm and 22nm technology nodes. The simulated results closely matched theoretical expectations and met the necessary performance specifications. Additionally, we designed the layout for the Cascode Current Mirror and Cascode Amplifier in Magic software, for the 180nm technology. Finally, we analyzed and compared the results from both 180nm and 22nm technologies based on LTspice simulations and the layout design in Magic (only for 180nm technology).