Two-stage amplifier with gain=500

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INTRODUCTION

An amplifier is an electronic circuit that acts like a voltage-controlled voltage source. Amplifiers are electronic components made from a complex combination of resistors, capacitors and transistors. In this project, we first make the schematic of a two-stage amplifier circuit, and then by changing the resistances, we bring its gain to the desired value, and by analyzing its DC and AC states, we get its working area and gain and make sure of it.
The first stage, the general schematic of two-stage amplifiers: The reason for the presence of the capacitor in the input and

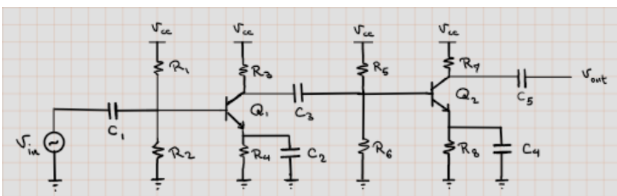
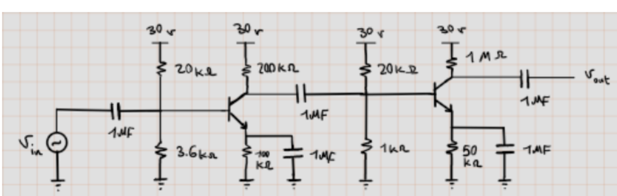


FIG. 1. This is the general schematic circuit of a two-stage Bjt amplifier.

output is to eliminate the effect of constant voltage on the input voltage. The other capacitors are because the current generated from the collector reaches the ground, and we have placed the emitter resistors because it does not drain the current.
The second stage: Now we make the circuit by applying values.



We implement this circuit in Proteus to see its performance. We see that the input voltage is 20 millivolts and the output voltage is 10 volts:

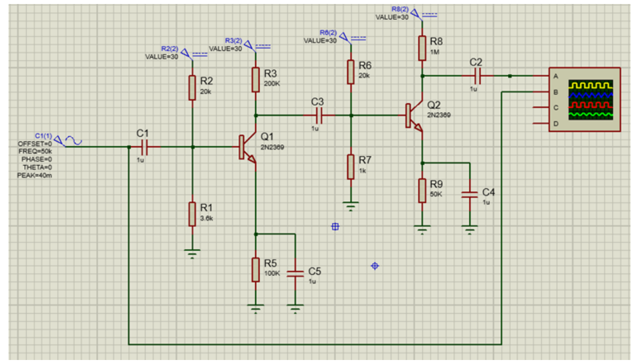
$$A_v = \frac{v_0}{v_{in}} = \frac{10v}{20mv} = 500$$

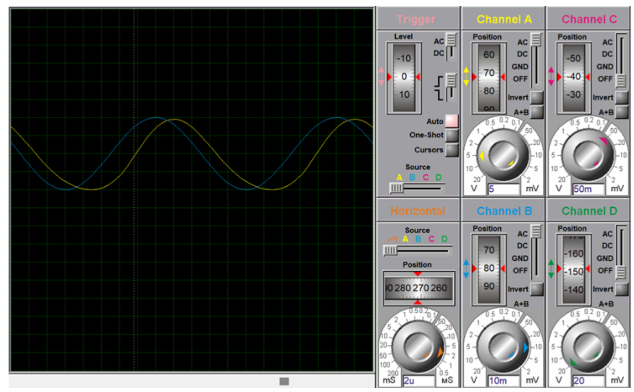
For dc analysis we have this circuit:

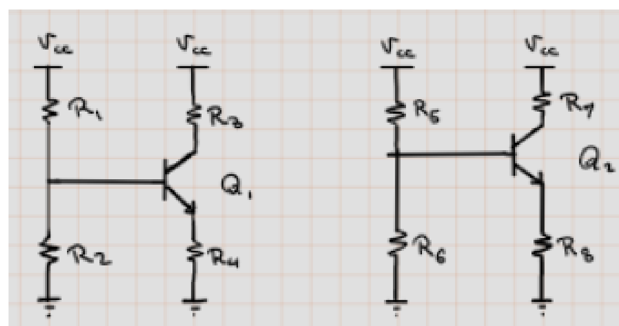
that

$$R_1 = 20k\Omega$$

$$R_2 = 3.6kOmega$$







$$R_3 = 200k\Omega$$

$$R_4 = 100k\Omega$$

$$R_5 = 20k\Omega$$

$$R_6 = 1k\Omega$$

$$R_7 = 1MOmega$$

$$R_8 = 50k\Omega$$

It gives the result:

$$V_{CE_1} = 18.01v > 0.2 \Rightarrow ison, Ic1 = 21A$$

$$V_{CE_1} = 11.46v > 0.2 \Rightarrow ison, Ic1 = 17.66A$$

$$\Rightarrow g_{m_1} = \frac{21 \times 10^{-3}\ \ mA}{25\ \ mv}$$

$$= 0.84 \times 10^{-3} \frac{1}{mathrm\Omega} \quad , \quad r_{\pi_1} = 2M\Omega\ ,$$

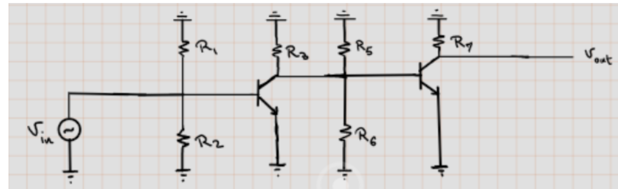
r_o is dependent on temperature

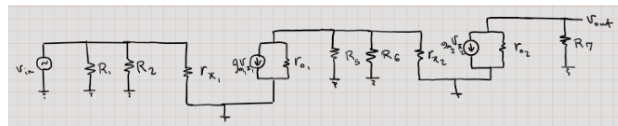
$$\Rightarrow g_{m_2} = \frac{17.66 \times 10^{-3}\ \ mA}{25\ \ mv}$$

$$= 0.71 \times 10^{-3} \frac{1}{mathrm\Omega} \quad , \quad r_{\pi_2} = 4k\Omega\ ,$$

r_o is dependent on temperature

For the AC analysis model, we have:





In the following, we will implement this circuit in a practical way.