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Introduction to Electronics

Lab 4 Part 3

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Exercise 3

1. Circuit was built.I found beta to be equal to 208.3 in my Exercise 1 of this lab, and RE is a 1000 ohm resistor. Input impedance for common collector circuit is beta \* RE, so 208.3\*1000, or 208.3k ohms. Output impedance is roughly RE, so 1000 ohms, and Avoc is RE/(rE+RE), where rE is much smaller than RE. This makes AVoc roughly 1, I will be calling it 0.99.

2. Values were set.

3. A screenshot of a computer

Description automatically generated

Using the values we found, AVoc is Vout / Vin, or 183.41/193.3 which equals a gain of 0.949.

4. RSig was changed.

5. A screenshot of a computer

Description automatically generated

VRSig equals 203.1 mV – 113.96 mV, or 89.14 mV. Current can be calculated by doing VRSig / Rsig (1000 ohms). This makes Iin equal to 89.14 uA. Rin is then Vin/Iin, or 203.1 mV / 89.14 uA, or 2278 ohms.

6. A screenshot of a computer

Description automatically generated

We used a 1k ohms test resistor to measure the current. Vtest = C1 – C2 or 124.5 mV. Iout = Vtest/Rtest or 124.5 uA. Rout = C2/Iout, which is 626.5 ohms.

7. A screenshot of a computer

Description automatically generated

AV = Vout/Vin = 183.07/192.96 = 0.949

The experimental AVoc is very close to the analytic estimates (a little bit less than 1). Rin and Rout differ a bit more, with Rout being somewhat close and Rin being nowhere near the value that was estimated.

Exercise 4

1. Circuit was built.

A diagram of electrical wiring

Description automatically generated

2. DC bias characteristics were found to be consistent. In an emitter circuit Zin is beta\*RE, Zout is Rc, and AVoc is Rc/rE. RE is 1k, Rc is 1k, and rE is small (think 100). Using the beta found in last lab at 208.3, this makes Zin 208k ohms, Zout 1000 ohms, and AVoc 10.

3. Values were set.

4. A screenshot of a computer

Description automatically generated

AVoc = Vout/Vin, 1.03V/152.4mV, or 6.76

5. A screenshot of a computer

Description automatically generated

VRsig = C1-C2 or 50.03mV. Iin = VRsig/Rsig = 500.3 uA. Rin = Vin/Iin = 202.76mV/500.3uA or 405 ohms.

6. A screenshot of a computer

Description automatically generated

Vtest = C1-C2 = 100.61mV. Iout = Vtest/Rtest = 100.61uA. Rout = 102.83mV/100.61uA, or 1022 ohms.

7. A screenshot of a computer

Description automatically generated

Av = Vout/Vin = C2/C1 = 0.51112/152.07mV = 3.36

The experimental Rin is actually quite close to the analytical estimated version of Rin, but AVoc and Rout are both pretty far off.

8. A graph of a graph showing a number of steps

Description automatically generated with medium confidence A diagram of a graph

Description automatically generated with medium confidence

3db cutoffs can be seen at roughly 10Hz and roughly 200 Hz.

A screen shot of a graph

Description automatically generated

High frequency cutoff at roughly 100kHz (and dielectric breakdown at roughly 10kHz)