LAB ASSIGNMENTS – TRANSISTORS

NPN & PNP TRANSISTORS

DMM readings of transistors (set your DMM to diode mode)

+	-	Reading 2N3904	Reading 2N3906
B	E		
E	B		
B	C		
C	B		
C	E		
E	C		

Do the readings make sense to you? Explain your measurements.

SMALL SIGNAL

Voltage gain of a small-signal amplifier could be hundreds. To avoid cutoffs on the output voltage, we'd like to have a small ac base voltage.

One way to reduce distortion is by keeping the ac base voltage small. When the signal is small, the changes in ac emitter current are almost directly proportional to the changes in ac base voltage. In other words, if the ac base voltage is a small enough sine wave, the ac emitter current will also be a small sine wave with no noticeable stretching or compression of half cycles. In our lab, the function generator can produce a peak-to-peak 2V input signal. I can reduce it 10 times by pushing down or pulling out the -20dB button.

200mV is still too much for our input signal. It will be nice to further reduce the signal another 20dB. One solution is to use a -20dB attenuator with 50 Ω impedance. I only have a couple of these attenuators. Another quick solution is to build a voltage divider with two resistors (not too big, less than 1k) so that $v_{out} \approx \frac{1}{10} v_{in}$. Set your function generator output to around 200mV$_{pp}$ at anywhere from 5kHz to 20kHz, and you should be able to get a 20mV to 40mV output. Draw your schematic on the lab book and show your calculation. Connect your scope's yellow CH1 to v_{out} and cyan CH 2 to v_{in}. Do the waves make sense to you? Show your two signals to your TA/professor before you go to the next step. Take screenshots with measurements.

COMMON EMITTER AMPLIFIER

1. Build the amplifier showed in *Design Exercises ii*. Connect the output from the previous Small Signal step to the base series coupling capacitor C_1. Leave the oscilloscope's yellow CH1 to where it was (~20mV_{pp}). Disconnect the cyan CH2 and connect it to V_C. You should observe that the cyan wave has a dc offset and a phase shift compared to the yellow wave. Show the signals to your TA/professor. Take a screenshot with measurements.
2. Connect a 10kΩ load resistor to this amplifier. Don't forget the coupling capacitor C_2. Get a third BNC cable and plug it to the magenta CH3 ($v_{out(load)}$). Use this cable to measure the loaded output wave. The magenta sine wave should have the same peak-to-peak value and in phase with the cyan wave without the dc offset. Measure the loaded voltage gain $A_{v(loaded)}$. Show the 3 signals to your TA/professor. Repeat with a $2k\Omega$ and a 500Ω resistor. Take a screenshot for each load resistor.