Physics 517/617 Experiment 4

Transistors - 1

1) Build the following circuit. Vary R between 300 Ω and 10 kΩ. Measure V_R, V_{CE}, and I_C. Plot I_C, β ($= h_{fe} = I_C/I_B$), V_{CE}, vs. I_B. Compare your results with Fig. 11 (this figure has V_{CE} fixed at 10V) of the 2N3904 spec sheet. What is the saturation current and saturation voltage (V_{CE} at saturation)? The light bulb is in the circuit to let you know that current is flowing. If you don't want to use a bulb, use a small resistor ($< 100\ \Omega$) in its place. A resistor box for R may be useful in this part.
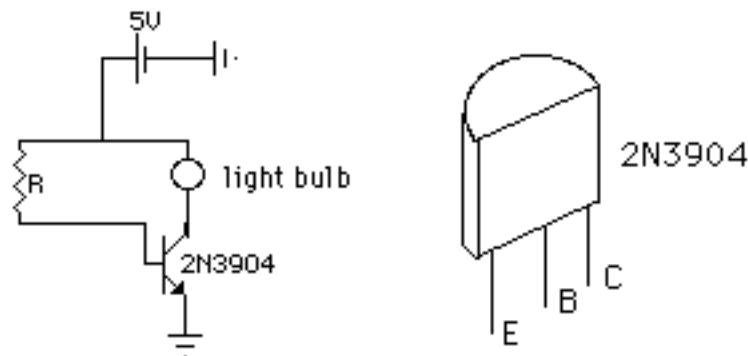
2) Design a single stage common emitter amplifier. The amplifier should have the following specs:
a) flat frequency response from 30 to 10 kHz (i.e. -3 dB point at 30 Hz)
b) voltage gain of ≈ 100
c) input impedance $> 300\ \Omega$

3) Measure the following properties of your amplifier and compare your results with expectations:
a) DC voltages at operating point.
b) plot voltage gain as a function of frequency (30-100 kHz).
c) input and output impedance.
d) capture using the PC's WAVESTAR program a picture of the amp's output response to a large input sine wave.

Suggested References:
    Class notes of course.
    Simpson Experiment 13 (P. 862) and 14 (P. 864).
    Student Manual for Art of Electronics (most of Chapter 2).