Experiment 1

Construct a 4 resistor bias circuit for a BJT amplifier as shown in figure P4.8 in the text (page 231) as a starting point with \( R_{B1} = 100 \, \text{k}\Omega \), \( R_{B2} = 25 \, \text{k}\Omega \), \( R_C = 4 \, \text{k}\Omega \), and \( R_E = 1 \, \text{k}\Omega \) as starting values for the resistors. You will, most likely, need to adjust these values slightly based on the beta for the transistor you plan on using (you may use the same transistor as used in lab 3). Verify the DC bias results in a \( V_{CE} \) around 7 ± 1V and an \( I_C \) around 2 ± 0.5 mA when supplied with a \( V_{CC} = 20 \, \text{V} \). You should verify that your design is beta stable as well (you may use OrCad to verify stability by trying a betas of 50, 100, 150, and 200). The BJT used in your circuit could be either the 2N2222 or 2N3904. Be sure to compare your measured DC results with the OrCad analysis.

Experiment 2

Connect a resistive load to your circuit from experiment 1 with a value equal to approximately 2*R\(_C\) and connected to the collector terminal through a capacitor (tens of \( \mu \text{F} \) range). Connect an input AC signal to the base again through a capacitor (again tens of \( \mu \text{F} \) range). You will also need another capacitor to by-pass the emitter resistor (5 – 10 times larger than the other two). Verify that the DC values have not changed as a result of the connections. Analyze the circuit using OrCad over a frequency range of 10 Hz to 100 kHz with an AC input signal of around 250 mV RMS. Please note that your input may, based on the voltage gain of your design, have to be adjusted to keep the output from distorting. Use the scope and observe the input and output (load voltage) signals for several frequencies in the 100 to 100 kHz range. Comment on the results and compare them to the OrCad analysis. Repeat the experiment without the capacitor by-pass of the emitter resistor. Again compare your measured results with those of OrCad. You should also try and explain the response changes related to the coupling (input and output) and by-pass (around \( R_E \)) capacitors. What are the maximum (approximately) input signals at 5 kHz that do not cause a significant distortion of the output signal?