1. Shown below is a single stage common emitter amplifier using a BJT as the active device. Assume the dc voltage drop from base-to-emitter is 0.65 V, the Early Voltage is 170 V, the thermal voltage $V_T = 25.9 \text{ mV}$, and the base spreading resistance is 10 Ω. The component values are $R_{B1} = 73 \text{kΩ}$, $R_{B2} = 173 \text{kΩ}$, $R_{E1} = 3.6 \text{kΩ}$, $R_{E2} = 18 \text{Ω}$, $R_C = 6.2 \text{kΩ}$, and $R_L = 10 \text{kΩ}$. Also assume that $C_1 = C_2 = 22 \mu\text{F}$ and $C_E = 330 \mu\text{F}$. The dc power supply voltage is $V^+ = 15 \text{V}$.

2. For the circuit parameters indicated in the diagram, use National Instruments (Multisim) and LTspice to determine:

   • the dc operating point of the circuit, viz. the dc voltage at each terminal of the transistor and the current flowing into the collector and base leads and out of the emitter.

   • the small signal ac voltage gain, viz. a plot of the gain, $A_v$ versus frequency where the frequency range is from 0.1 Hz to 100 MHz.

   • the positive and negative clipping levels, viz. the maximum and minimum possible values of the output voltage, $v_o$.

   • plot of the output voltage versus time for 2 cycles of the input for an input signal a sine wave with a frequency of 1 kHz and a peak value 0.7 V.

   • plot of the output voltage versus frequency for a frequency span from dc to 10 kHz, viz. the spectra of the output with an input signal a sine wave with a frequency of 1 kHz and a peak value 0.7 V. Plot the output voltage on a log scale.

   Assume that the SPICE parameters for the BJT are: saturation current, $6.734 \text{ fA}$; forward beta, 100; Early voltage, 170 V, zero-bias base collector capacitance, $3.638 \text{ pF}$; forward transit time, 301.2 ps, and base spreading resistance, 10 Ω.