ECE 3043
Summer 2018 Homework Problem Set 11 for Experiment No. 11
Due Second Meeting Week of July 16

1. Shown below is a single stage common emitter amplifier using a NPN BJT as the active device. For the circuit parameters indicated in the diagram, use both LT and National Instruments SPICE 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 $10\,\text{Hz}$ to $100\,\text{MHz}$.

- 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 frequency for a frequency span from dc to $10\,\text{kHz}$. Plot the output voltage on a log scale, viz. the spectra.

The circuit component and source values are: $V^+ = 15\,\text{V}, C_1 = 0.22\,\mu\text{F}, C_2 = 10\,\mu\text{F}, C_E = 100\,\mu\text{F}, R_{B1} = 73\,\text{k}\Omega, R_{B2} = 173\,\text{k}\Omega, R_{E1} = 4.3\,\text{k}\Omega, R_{E2} = 73\,\Omega, R_C = 7.3\,\text{k}\Omega$, and $R_L = 4.3\,\text{k}\Omega$. Assume that the SPICE parameters for the NPN BJT are: saturation current, $6.734f\,\text{A}$; forward beta, 416; Early voltage, $74.03\,\text{V}$, zero-bias base collector capacitance, $3.638\,\text{pF}$; forward transit time, $301.2\,\text{ps}$, and base spreading resistance, $10\,\Omega$.

3. Verify the SPICE solution for the above with a hand calculation using the parameters given for the SPICE simulation. Calculate the dc operating point and mid-band small signal voltage gain.