ECEN 325
Homework #5

Due: 03-24-2015, 5:00PM
Homeworks will not be received after due.
Instructor: Sam Palermo

1. **(50 points)** Characterize the 2N2222 NPN-BJT in PSpice. Obtain the values for $\beta_{DC}$, $\beta_{AC}$, $r_\pi$, $g_m$, and $r_o$ at $I_C=0.5$ mA.
   - In order to obtain these values, **4 plots must be generated**. For more details, refer to Dr. Silva’s notes posted on the website: [http://www.ece.tamu.edu/~spalermo/ecen325/Chapter%20Va.pdf](http://www.ece.tamu.edu/~spalermo/ecen325/Chapter%20Va.pdf)
   - **2 input characteristic plots** ($I_C$ vs $V_{BE}$ & $I_B$ vs $V_{BE}$) with the collector-emitter voltage fixed around 1.5 V. From the above notes, examples on how to extract $g_m$ and $g_{\pi}=1/r_\pi$ are shown on pages 21 and 23, respectively.
   - **2 output characteristic plots** ($I_C$ vs $V_{CE}$ & $I_C$ vs $I_B$) with the base-emitter voltage fixed such that the $I_C$ is within 100µA-4mA. For $\beta_{DC}$ and $\beta_{AC}$, an example is shown on page 24. For $g_o=1/r_o$, an example is shown on pages 22 (bottom) and 23 (top).

2. **(50 points)** For the following circuit, bias your transistor such that $g_mR_C=10$ (gain of -10V/V); $R_C$ is the resistance connected at the collector of the transistor. Fix the collector-emitter voltage such that the transistor operates in the active region.
   a) Simulate in PSpice and show the bias currents and voltages
   b) Simulate the circuit for AC analysis. Plot the frequency response of the circuit from 10Hz up to 10 MHz.

![Diagram](image)

Explain the bode plots, and justify the presence of zeros and poles, if any.