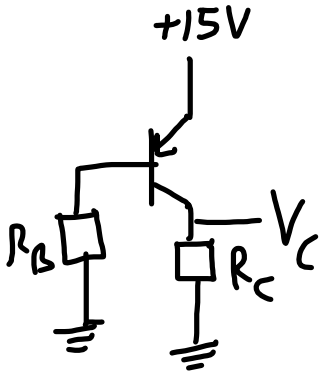


EE 321 Analog Electronics, Fall 2012

Quiz 7, November 5, 2012

1. Design a common-emitter PNP amplifier using 0 and 15 V supplies, and $\beta = 100$, with the following constraints: $V_C = 7.5$ V. Output resistance is 1 k Ω , the base is biased with a single resistor to ground. Give values of all resistors.

THE AMPLIFIER LOOKS LIKE THIS:



$$R_C = R_{OUT} = 1 \text{ k}\Omega$$

$$V_C = 7.5 \text{ V} = R_C I_C$$

$$\Rightarrow I_C = 7.5 \text{ mA}$$

$$I_B = \frac{I_C}{\beta} = \frac{7.5 \text{ mA}}{100} = 75 \mu\text{A}$$

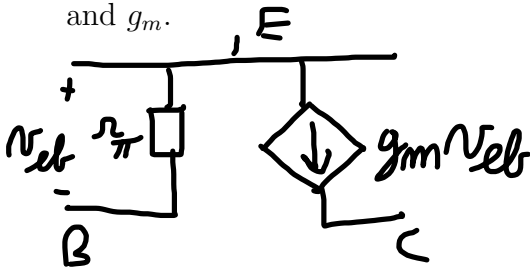
$$V_B = 15 \text{ V} - 0.7 \text{ V} = 14.3 \text{ V}$$

$$R_B = \frac{V_B}{I_B} = \frac{14.3}{75} = 0.19 \text{ M}\Omega$$

$$R_C = 1 \text{ k}\Omega$$

$$R_B = 190 \text{ k}\Omega$$

2. Draw the small-signal π -model for this circuit (it is PNP so upside-down), and give r_π and g_m .



$$g_m = \frac{I_C}{V_T} = \frac{7.5 \text{ mA}}{25 \text{ mV}}$$

$$= 0.3 \text{ S}^{-1}$$

$$r_\pi = 333 \text{ }\Omega$$

$$g_m = 0.3 \text{ S}^{-1}$$

$$r_\pi = \frac{\beta}{g_m} = \frac{100}{0.3} = 333 \text{ }\Omega$$

3. What is G_{vo} for a source with output resistance 1 k Ω ?

$$G_{vo} = \frac{r_\pi}{R_s + r_\pi} A_{vo} \quad A_{vo} = -g_m R_C$$

$$= -\frac{r_\pi}{R_s + r_\pi} g_m R_C = \frac{333}{10^3 + 333} 0.3 \cdot 10^3 = -74.9$$

$$G_{vo} = -74.9$$