

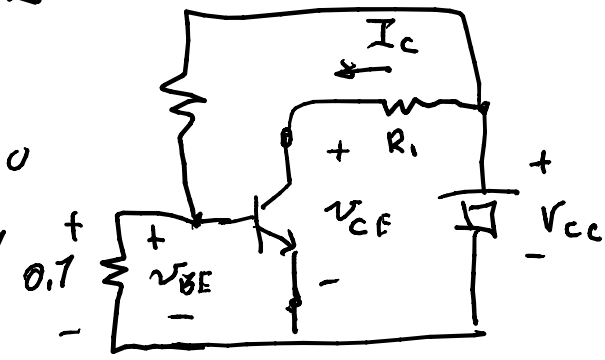
$$y_{11} = g_{\pi} = i_b / v_{be} \quad (v_{ce} = 0)$$

$$y_{21} = \frac{i_c}{v_{be}} \Big|_{v_{ce}=0} = \frac{g_m v_{be}}{v_{be}} \Big|_{v_{ce}=0} = g_m$$

$$Y = \begin{bmatrix} g_{\pi} & 0 \\ g_m & g_r \end{bmatrix}$$

$$y_{22} = \frac{i_c}{v_{ce}} \Big|_{v_{be}=0}$$

How to bias



$$V_T = \frac{kT}{q}$$

$$g_m = \frac{I_c}{V_T}$$

$$g_m \downarrow \text{ if } V_T \uparrow \Rightarrow T \uparrow$$

