DC Equations

$I_C = I_S e^{|V_{BE}|/V_T}$

$V_T = 25\,mV$ at $300K$

$I_B = I_E/(\beta+1)$

$I_B = I_C/\beta$

$I_C = \alpha I_E$

$\alpha = \frac{\beta}{\beta+1}$

$\beta = \frac{\alpha}{1-\alpha}$

AC equations

$V_{be} = V_\pi = r_e i_e = r_\pi i_b$

$i_c = g_m V_{be}$

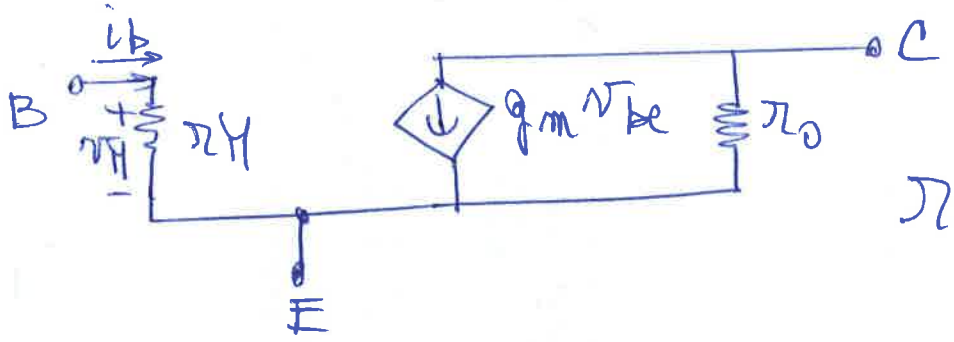
$r_\pi = \frac{V_T}{I_B}$

$r_e = \frac{V_T}{I_E}$

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

Small signal equivalent circuit

π- model



$r_o = \frac{V_A}{I_C}$

T model