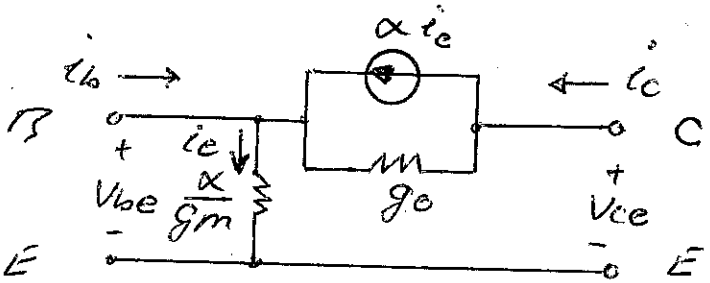
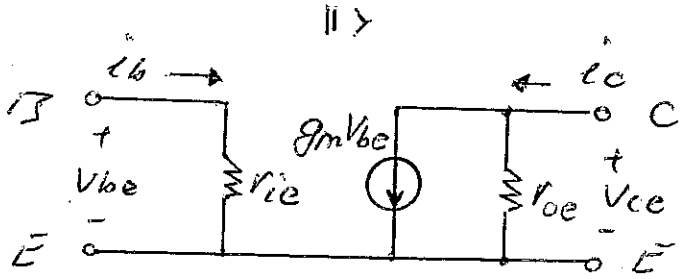
# CE Model Parameters

## from Physics (small signal equivalent)




Note: $g_o$ is conductance of reverse biased CB junction




Note: $\alpha i_e = g_m V_{be}$

$$\left\| r_{oe} = \left.\frac{V_{ce}}{i_c}\right|_{\substack{V_{be}=0 \\ (i_b=0)}} \qquad r_{ie} = \left.\frac{V_{be}}{i_b}\right|_{V_{ce}=0} = \frac{\alpha}{g_m}(1+\beta) = \frac{\beta}{g_m} \right\|$$

Applying the above definition the the original circuit yields:

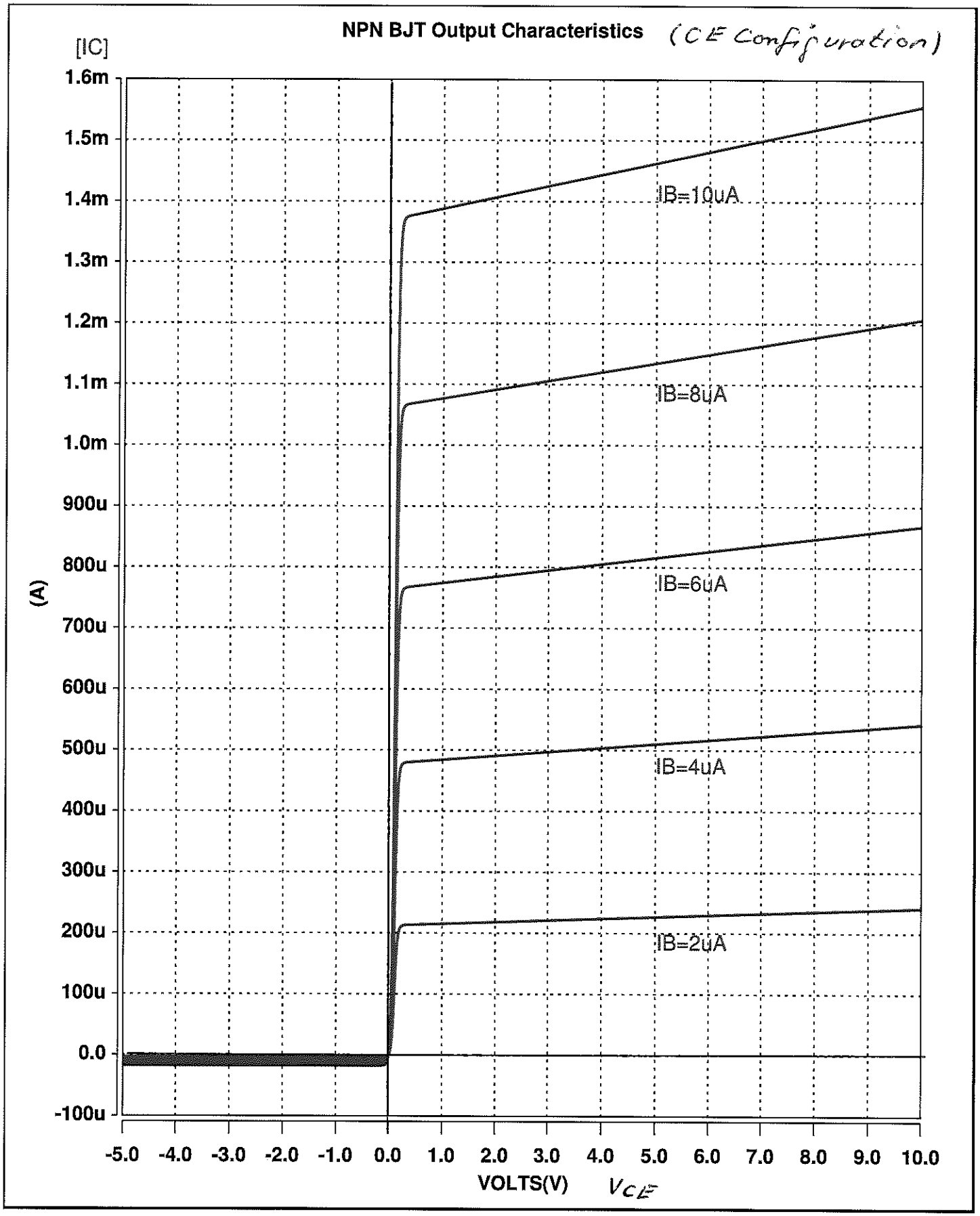
$$\left. V_{ce} \right|_{i_b=0} = i_o\left(\frac{\alpha}{g_m} + [1-\alpha]\frac{1}{g_o}\right)$$

or

$$\left\| \left.\frac{V_{ce}}{i_o}\right|_{i_b=0} = \frac{\alpha}{g_m} + [1-\alpha]\frac{1}{g_o} \approx [1-\alpha]\frac{1}{g_o} \right\|$$

$$\left| r_{ce} \approx [1-\alpha]\, r_o \right| \qquad 1-\alpha = \frac{1}{1+\beta}$$

$$r_o = 1/g_o$$


NPN BJT Output Characteristics (CE Configuration)
[IC]
1.6m
1.5m
1.4m
1.3m
1.2m
1.1m
1.0m
900u
800u
700u
600u
500u
400u
300u
200u
100u
0.0
-100u
(A)
IB=10uA
IB=8uA
IB=6uA
IB=4uA
IB=2uA
-5.0 -4.0 -3.0 -2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0
VOLTS(V)
VCE