EE236: Experiment No. 6
Bipolar Junction Transistor

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1 Overview of the experiment

1.1 Aim of the experiment

- Measure the forward active and reverse active parameters in common base and common emitter configurations
- Plot the output DC characteristics in CE configuration.
- Plot combined IC and IB vs VBE of a BJT on a semi-log scale (also called Gummel plot).
- Plot beta(DC) vs IC characteristics for constant VBC.
- Calculate r Pi model small signal parameters.

1.2 Methods

- We connected bjt with required common base,emmiter configurations accordingly and used 3 DMM's to measure required values
- Varied voltage and measured the required current and voltage parameters

2 Design

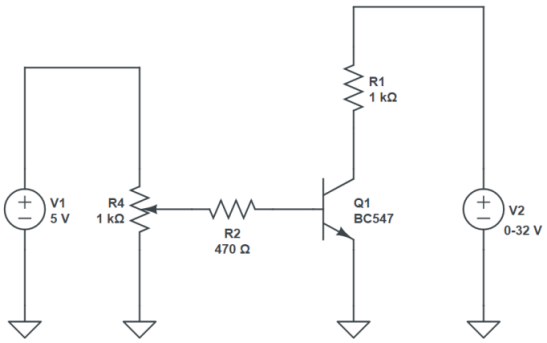

Figure 1: Circuit for measuring BJT Parameters in CE configuration

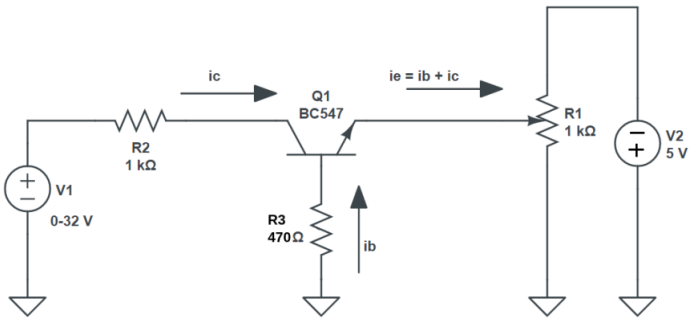

Figure 2: Circuit for measuring BJT Parameters in CB configuration

3 Simulations

3.1 Simulation results

BJT Parameters in CE configuration

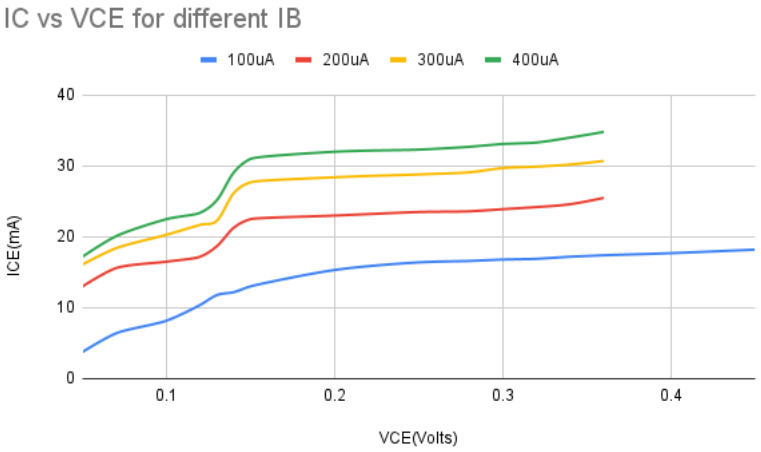

Figure 3: IC vs VCE for different IB

BJT Parameters in CB configuration

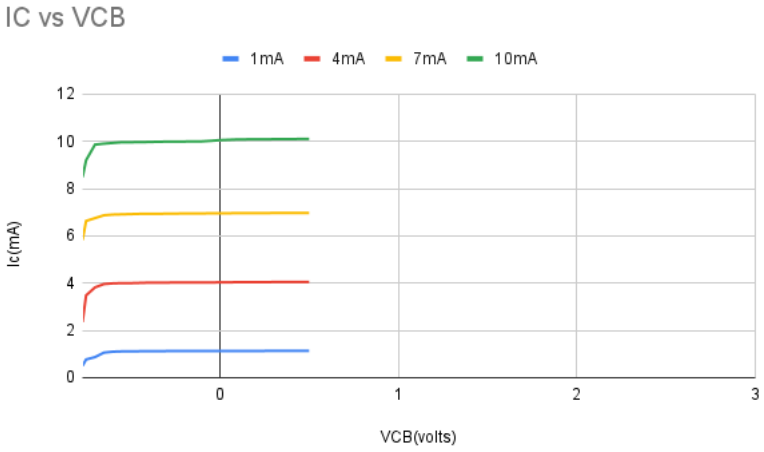

Figure 4: IC vs VCB for different IE

Gummel Plot

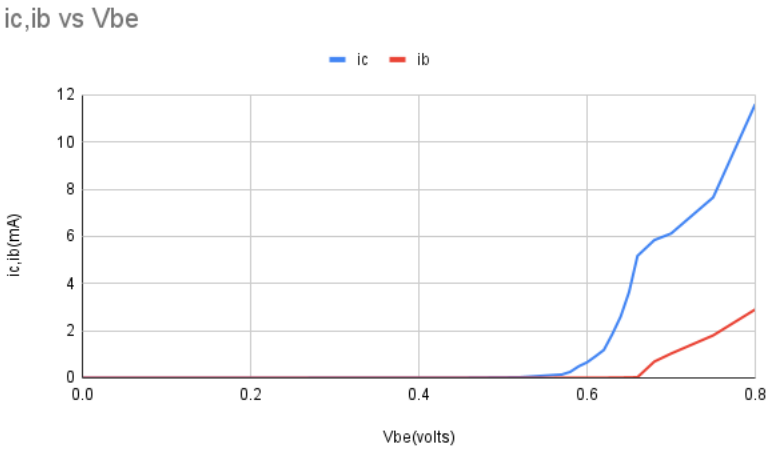

Figure 5: ic,ib vs Vbe

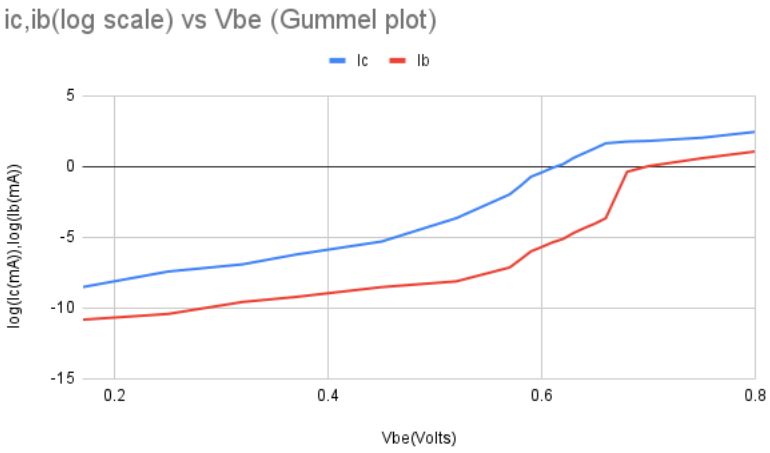

Figure 6: ic,ib(log scale) vs Vbe (Gummel plot)

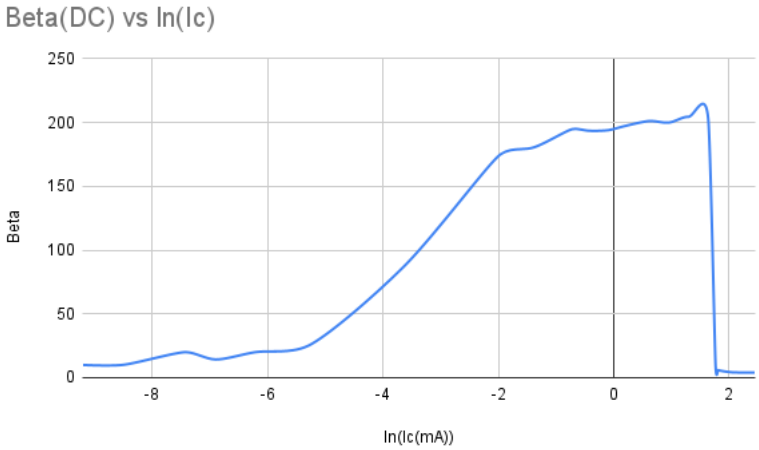

Figure 7: Beta(DC) vs ln(Ic)

4 Experimental results

BJT Parameters in CE configuration
As,

$$Ie = Ic + Ib \tag{1}$$

for each Ib we get different alpha and beta values.

$$alpha = ic/ie \tag{2}$$

$$beta = ic/ib \tag{3}$$

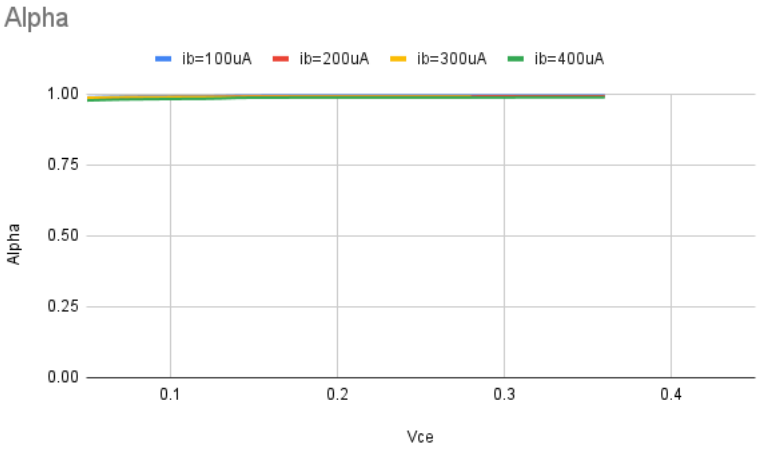

Figure 8: Alpha

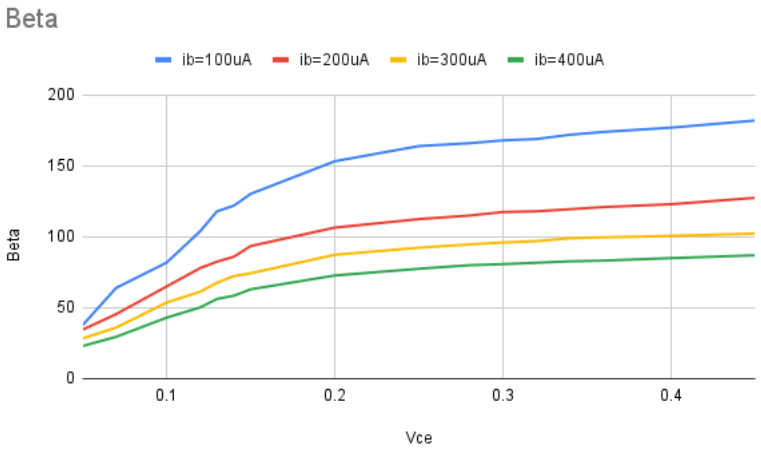

Figure 9: Beta

Alpha stayed approximately at.98 for different ib values.
Beta started quiet low and and increased as vce increases,and as we increase Ib beta value for a particular vce decreased.
From extrapolating we got the early voltage as -1.253v

BJT Parameters in CB configuration

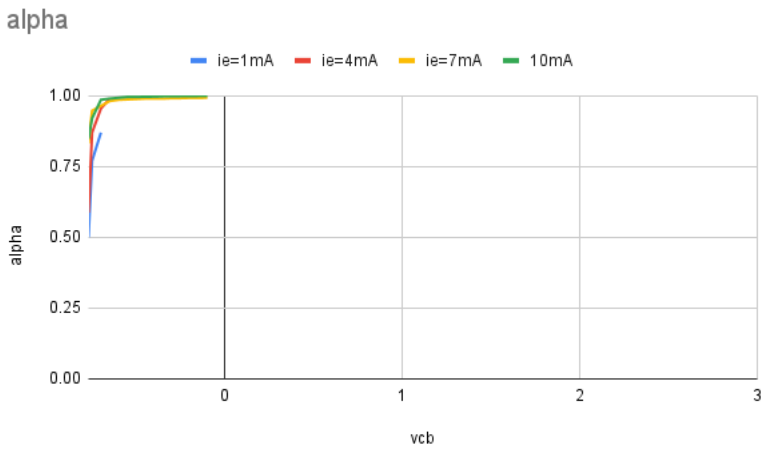

Figure 10: Alpha

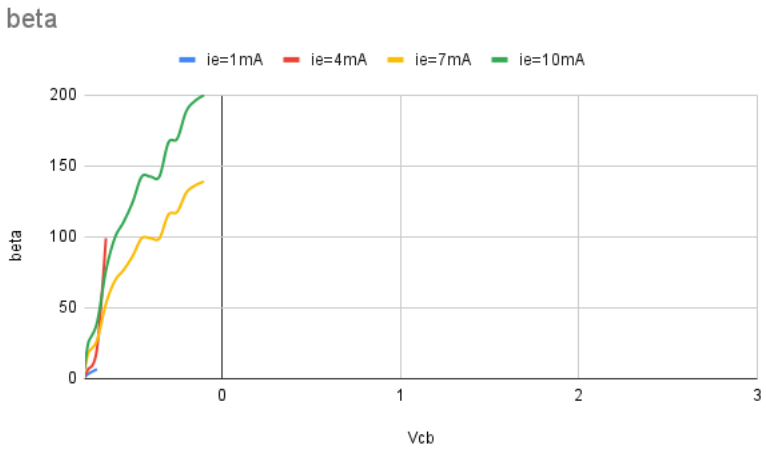

Figure 11: Beta

Here both alpha and beta are quiet low at initial values of vcb and increased later as vcb increases.

Small Signal Parameters
Ic = 4.5 mA and Vce=5V we got:
ib=.02mA
gm=Ic*vt = 4.5mA*0.026v=.117m Simon
beta=225
rpi=26.325e-3

5 Experiment completion status

The experiment was fully completed in the lab.