EE236: Experiment No. 6
Bipolar Junction Transistor

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October 8, 2022

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
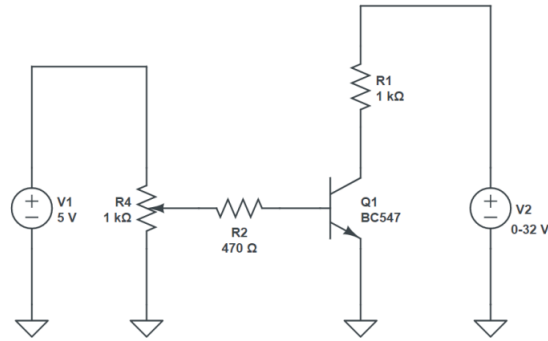
2 Design

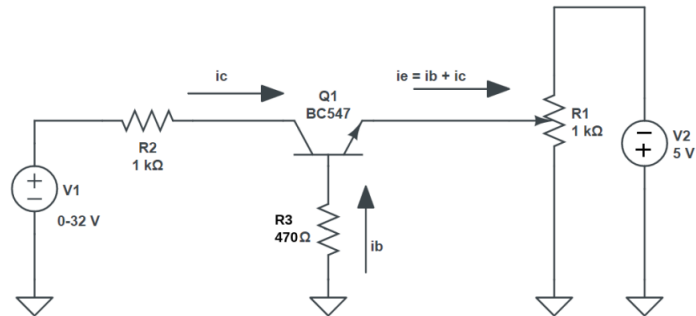Figure 1: Circuit for measuring BJT Parameters in CE configuration

Figure 2: Circuit for measuring BJT Parameters in CB configuration

3 Simulations

3.1 Simulation results
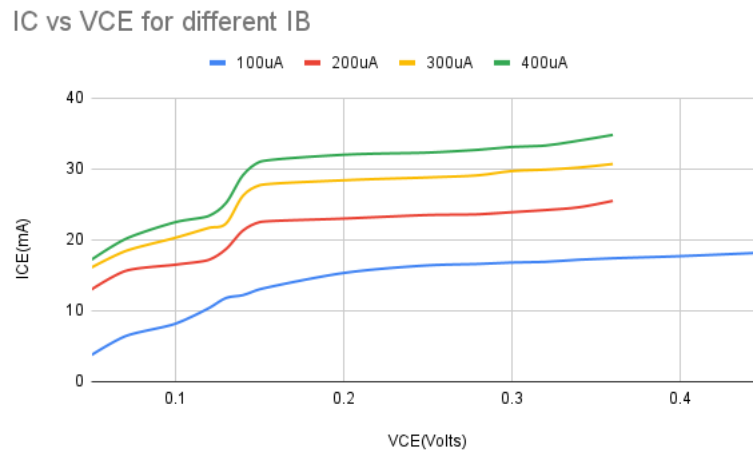
BJT Parameters in CE configuration

Figure 3: IC vs VCE for different IB
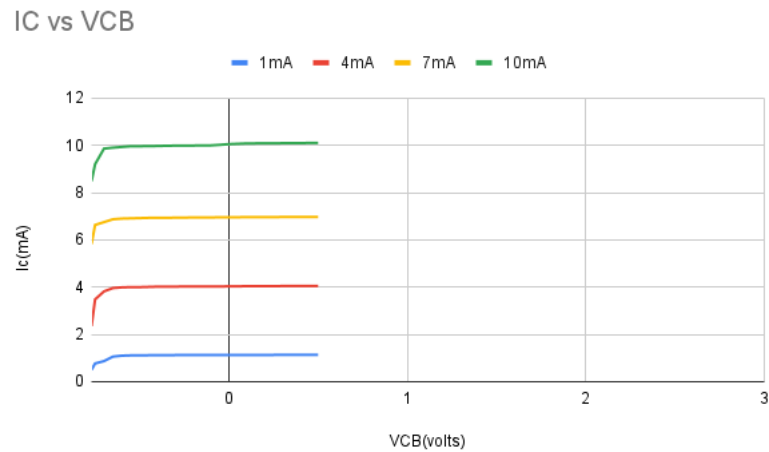
BJT Parameters in CB configuration

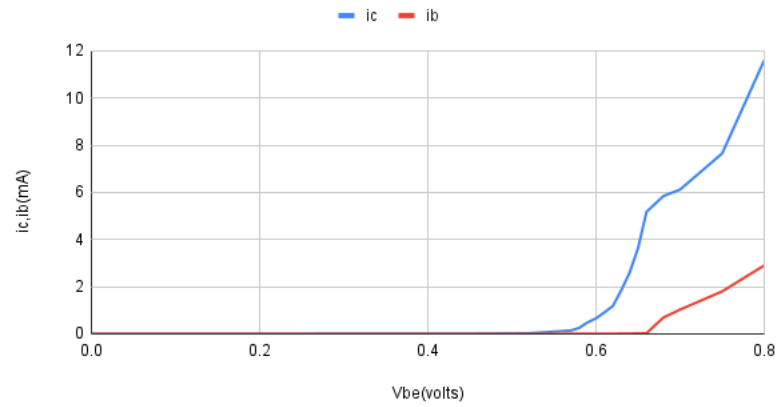Figure 4: IC vs VCB for different IE

Gummel Plot

ic,ib vs Vbe

Figure 5: ic,ib vs Vbe

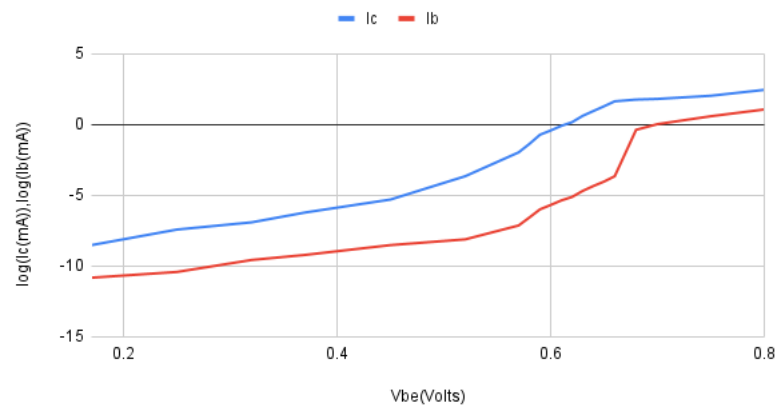ic,ib(log scale) vs Vbe (Gummel plot)

Figure 6: ic,ib(log scale) vs Vbe (Gummel plot)
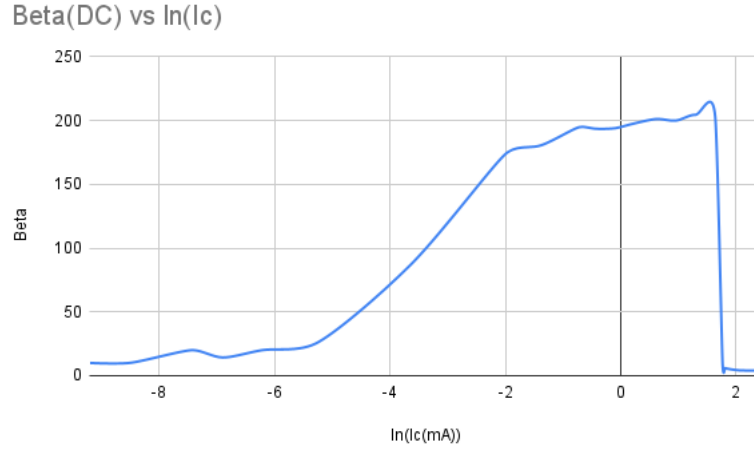
4

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.

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

$$beta = ic/ib \tag{3}$$
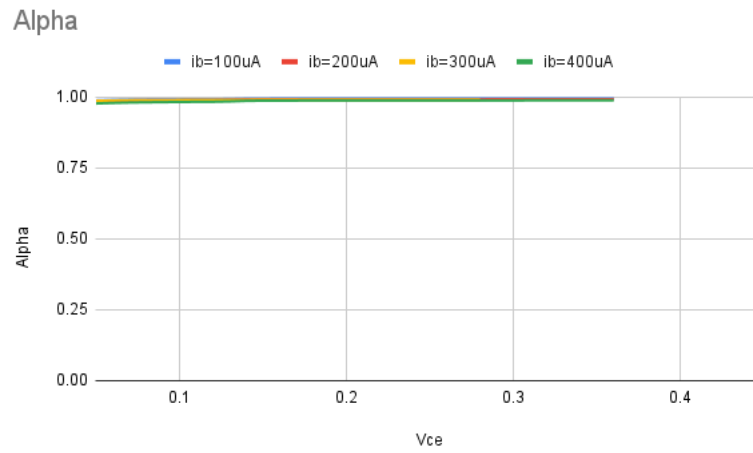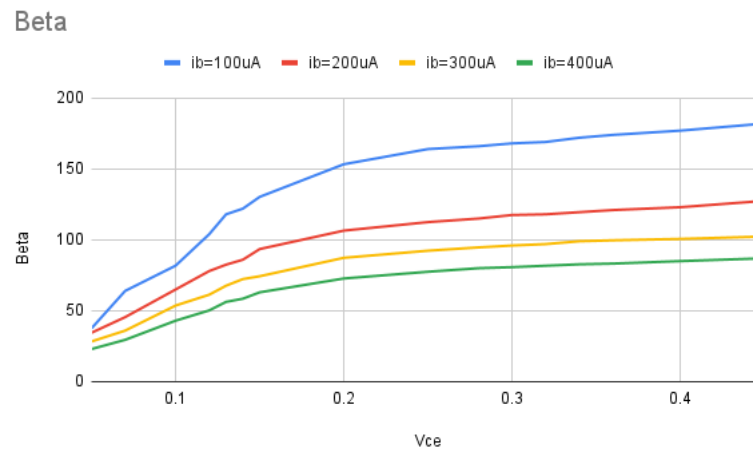
Figure 8: Alpha

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
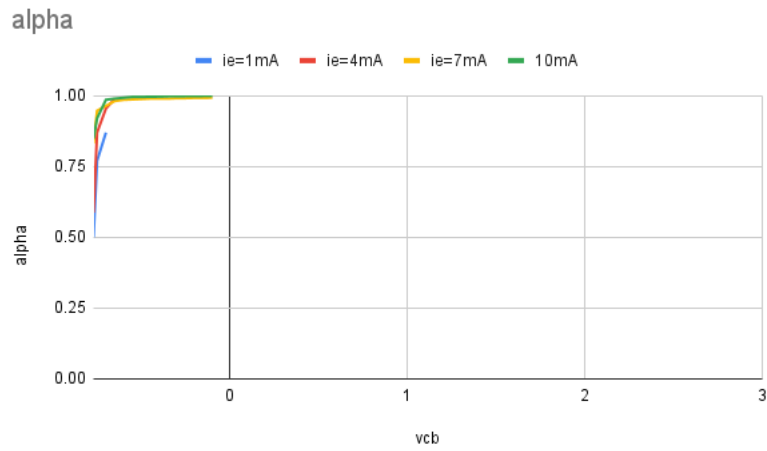
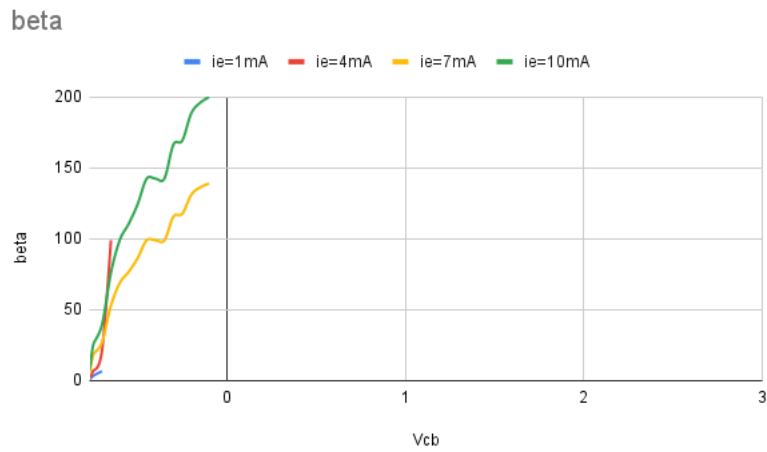## BJT Parameters in CB configuration

alpha

Figure 10: Alpha

beta

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=0.02mA

gm=Ic*vt = 4.5mA*0.026v=0.117mSimon

beta=225

rpi=26.325e-3

5 Experiment completion status

The experiment was fully completed in the lab. All that part which was asked to do was completed according to the best of my knowledge in the lab itself.