EE 236: Electronic Divice Lab
Lab No. 7

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Contents

1 BJT Parameters in CB configuration

1.1 Circuit Design

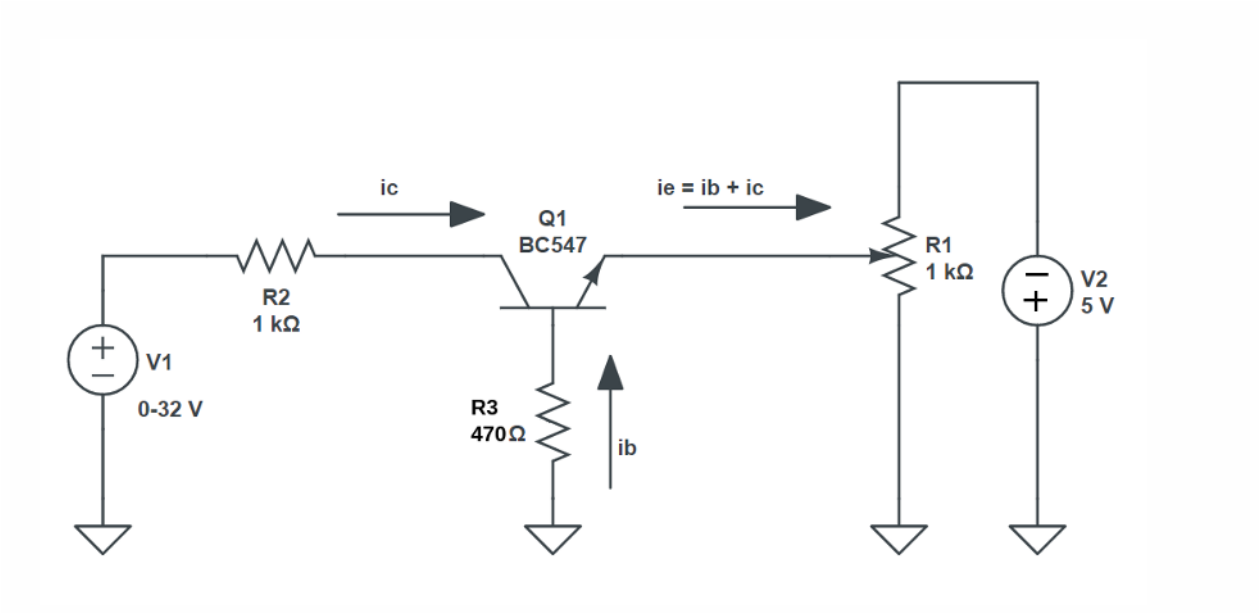

Figure 1: Circuit Diagram

1.2 Characteristics readings for different I_e

1.2.1 I_e = 3mA

V_{CB} (V)	I_C (mA)	α	β
-0.687	0.98	0.3267	0.4851
-0.677	1.42	0.4733	0.8987
-0.666	1.85	0.6167	1.6087
-0.650	2.28	0.7600	3.1667
-0.625	2.70	0.9000	9.0000
-0.556	3.09	1.0300	-34.3333
-0.137	3.16	1.0533	-19.7500
0.354	3.18	1.0600	-17.6667
0.849	3.17	1.0567	-18.6471
1.045	3.17	1.0567	-18.6471
1.243	3.17	1.0567	-18.6471
1.441	3.18	1.0600	-17.6667
1.638	3.18	1.0600	-17.6667
1.836	3.18	1.0600	-17.6667
2.820	3.19	1.0633	-16.7895
3.800	3.19	1.0633	-16.7895
4.800	3.20	1.0667	-16.0000
5.790	3.20	1.0667	-16.0000
6.770	3.22	1.0733	-14.6364

Table 1: Values of V_{CB}, I_C, α, and β

1.2.2 $I_e = 6\text{mA}$

V_{CB} (V)	I_C (mA)	α	β
-0.715	1.38	0.2300	0.2987
-0.711	1.81	0.3017	0.4320
-0.705	2.24	0.3733	0.5957
-0.700	2.67	0.4450	0.8018
-0.694	3.10	0.5167	1.0690
-0.686	3.52	0.5867	1.4194
-0.676	3.95	0.6583	1.9268
-0.663	4.38	0.7300	2.7037
-0.643	4.80	0.8000	4.0000
-0.385	5.45	0.9083	9.9091
0.600	5.46	0.9100	10.1111
1.590	5.47	0.9117	10.3208
2.560	5.48	0.9133	10.5385
3.550	5.49	0.9150	10.7647
4.540	5.50	0.9167	11.0000

Table 2: Values of V_{CB}, I_C, α, and β for $I_e = 6\text{mA}$

1.2.3 $I_e = 9\text{mA}$

V_{CB} (V)	I_C (mA)	α	β
-0.734	1.89	0.2100	0.7900
-0.733	2.30	0.2556	0.7444
-0.730	2.76	0.3067	0.6933
-0.726	3.18	0.3533	0.6467
-0.724	3.62	0.4022	0.5978
-0.719	4.05	0.4500	0.5500
-0.718	4.49	0.4989	0.5011
-0.712	4.91	0.5456	0.4544
-0.709	5.35	0.5944	0.4056
-0.693	6.16	0.6844	0.3156
-0.676	7.02	0.7800	0.2200
-0.647	7.89	0.8767	0.1233
-0.548	8.70	0.9667	0.0333
0.377	8.77	0.9744	0.0256
1.400	8.79	0.9767	0.0233
2.230	8.92	0.9911	0.0089
3.090	9.08	1.0089	-0.0089
4.060	9.10	1.0111	-0.0111
4.860	9.29	1.0322	-0.0322
5.850	9.30	1.0333	-0.0333

Table 3: Values of V_{CB}, I_C, α, and β for $I_e = 9\text{mA}$

1.3 Plots of characteristics of CB configuration for different I_e

1.3.1 $I_e = 3\text{mA}$

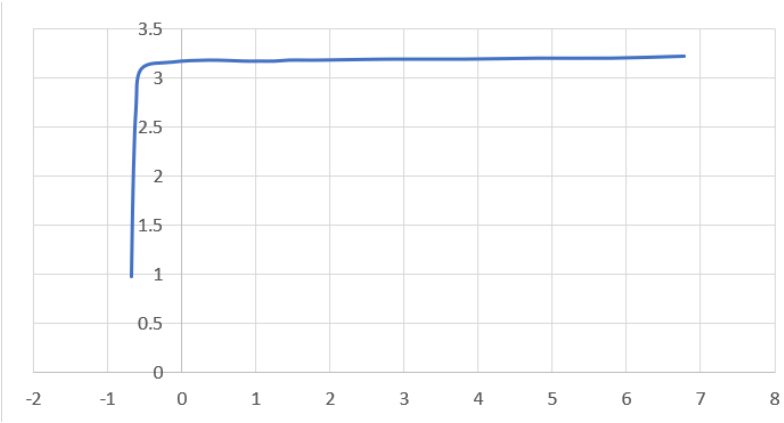

Figure 2: I_c vs V_{cb} for $I_e = 3\text{mA}$

1.3.2 $I_e = 6\text{mA}$

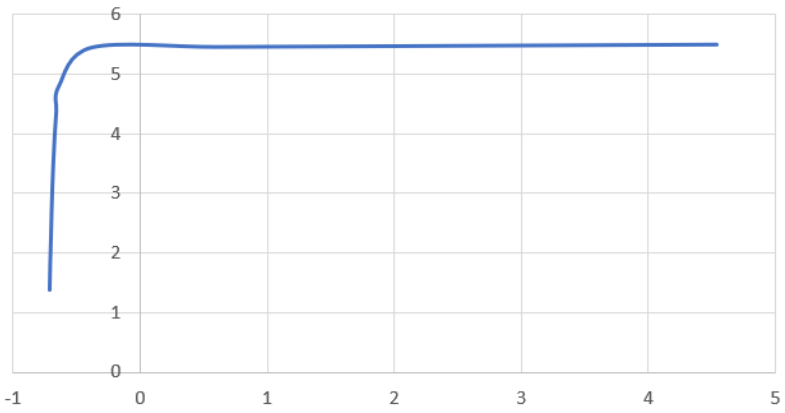

Figure 3: I_c vs V_{cb} for $I_e = 6\text{mA}$

1.3.3 $I_e = 9\text{mA}$

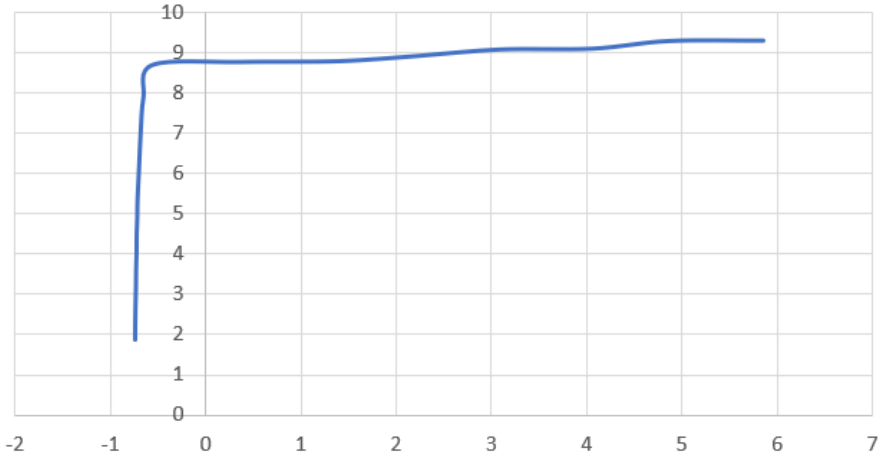

Figure 4: I_c vs V_{cb} for $I_e = 9\text{mA}$

1.4 Readings and plot for I_c and I_b for different V_{BE}

Taking $V_{BC} = 4V$

V_{BE} (V)	I_C (mA)	I_B (mA)
0.001	0.000	0.00000
0.023	0.002	0.00002
0.060	0.002	0.00002
0.440	0.003	0.00003
0.543	0.029	0.00029
0.553	0.040	0.00040
0.582	0.121	0.00121
0.600	0.235	0.00235
0.613	0.379	0.00379
0.621	0.539	0.00539
0.640	1.101	0.01101

Table 4: Values of V_{BE}, I_C, and I_B

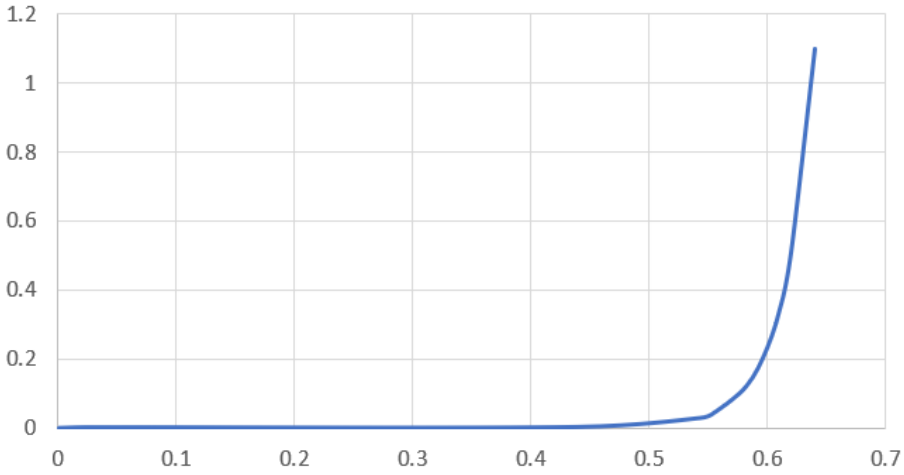

Figure 5: I_c vs V_{BE}

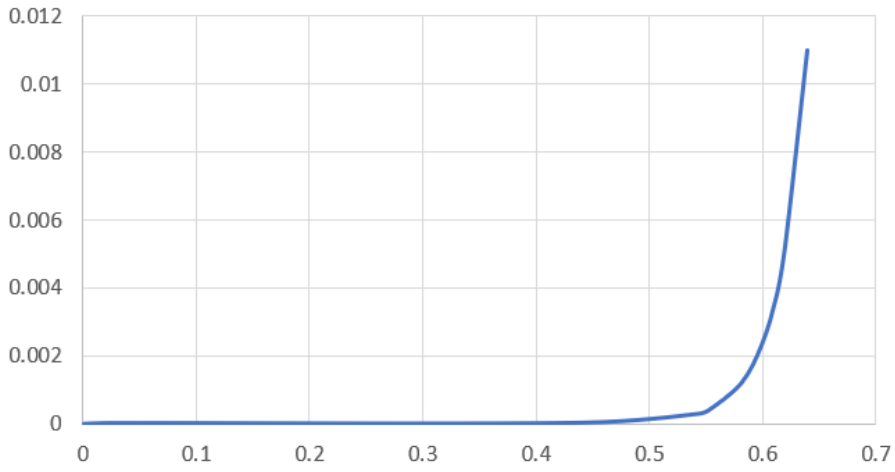

Figure 6: I_b vs V_{BE}

2 Frequency response of BJT vs HBT

2.1 Frequency response of BJT in CE configuration

Input Frequency (kHz)	Vo (mV pp)	log(Input Frequency)	dB Gain
1	1.86	3.00	11.41
5	1.84	3.70	11.32
10	1.84	4.00	11.32
50	1.82	4.70	11.22
100	1.80	5.00	11.13
150	1.78	5.18	11.03
200	1.74	5.30	10.83
250	1.70	5.40	10.63
300	1.64	5.48	10.32
350	1.58	5.54	10.00
400	1.54	5.60	9.77
450	1.46	5.65	9.31
500	1.42	5.70	9.07
550	1.36	5.74	8.69
600	1.30	5.78	8.30

Table 5: Voltage and dB Gain vs. Input Frequency

3-dB cutoff frequency = 525kHz

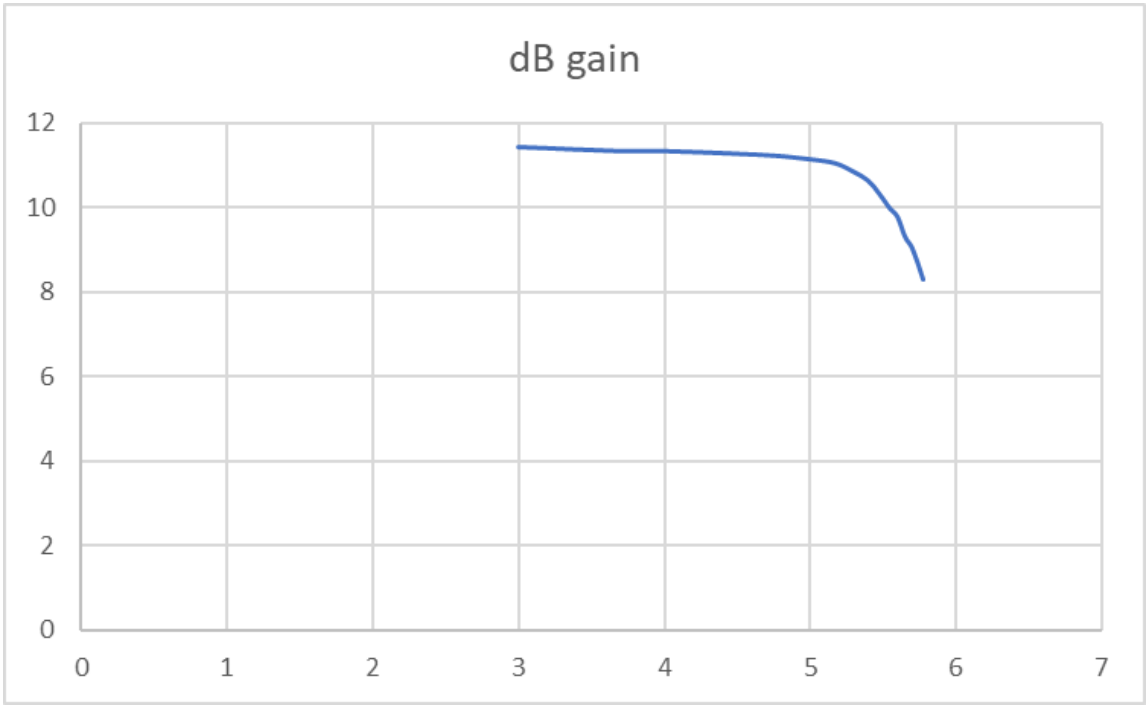

Figure 7: gain vs log(input freq)

2.2 Frequency response of HBT in CE configuration

Input Frequency (kHz)	Vo (mV pp)	log(Input Frequency)	dB Gain
1	1.28	3.00	8.16
5	1.296	3.70	8.27
10	1.296	4.00	8.27
50	1.28	4.70	8.16
100	1.28	5.00	8.16
150	1.28	5.18	8.16
200	1.24	5.30	7.89
250	1.24	5.40	7.89
300	1.22	5.48	7.75
350	1.22	5.54	7.75
400	1.20	5.60	7.60
450	1.18	5.65	7.46
500	1.16	5.70	7.31
550	1.12	5.74	7.00
600	1.10	5.78	6.85

Table 6: Voltage and dB Gain vs. Input Frequency

3-dB cutoff frequency = 850kHz