

EE 236: Electronic Device Lab

Lab No. 7

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1 BJT Parameters in CB configuration

1.1 Circuit Design

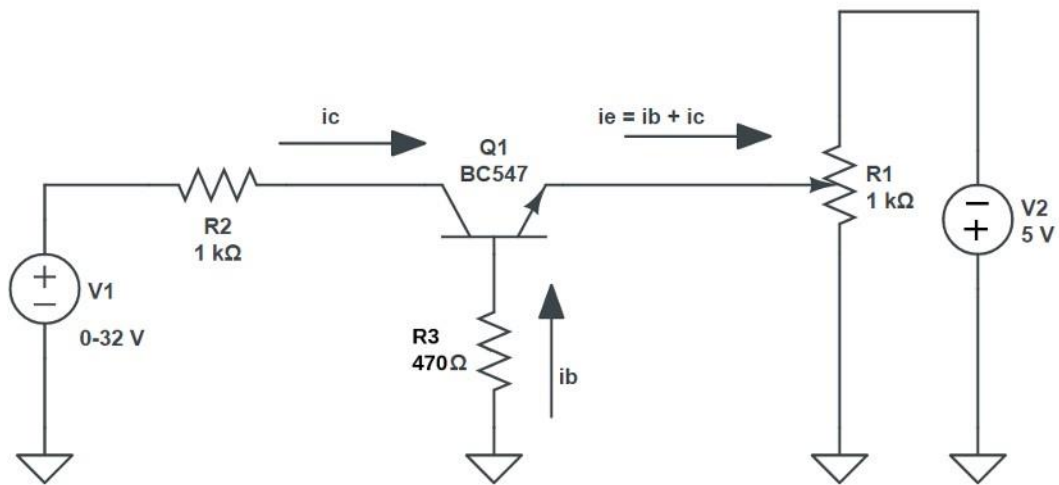


Figure 1: Circuit Diagram

1.2 Characteristics readings for different I_e

1.2.1 $I_e = 3\text{mA}$

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 $I_e = 3\text{mA}$

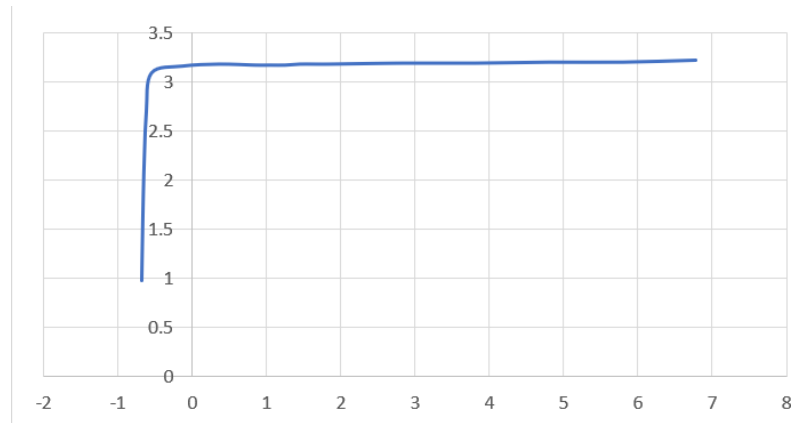


Figure 2: I_c vs V_{cb} for $I_e = 3\text{mA}$

1.3.2 $I_e = 6\text{mA}$

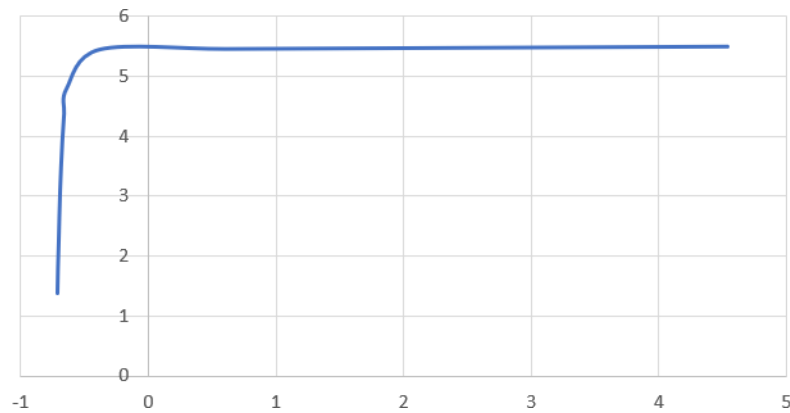


Figure 3: I_c vs V_{cb} for $I_e = 6\text{mA}$

1.3.3 $I_e = 9\text{mA}$

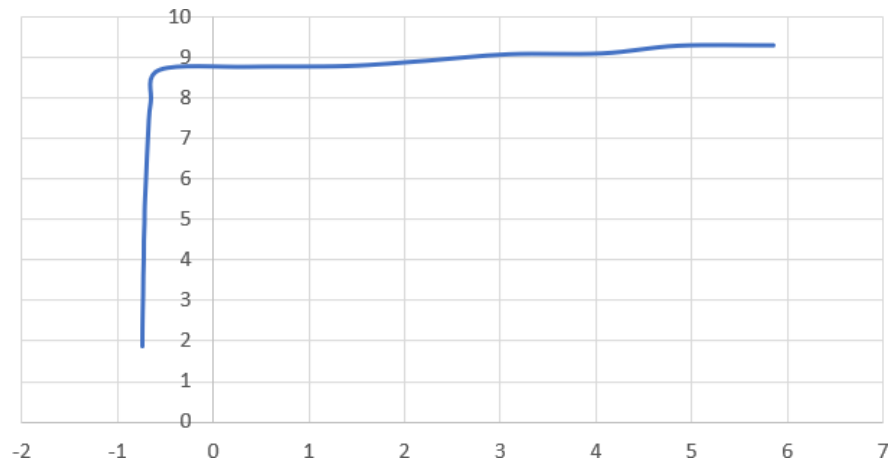


Figure 4: I_C vs V_{CB} for $I_E = 9\text{mA}$

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

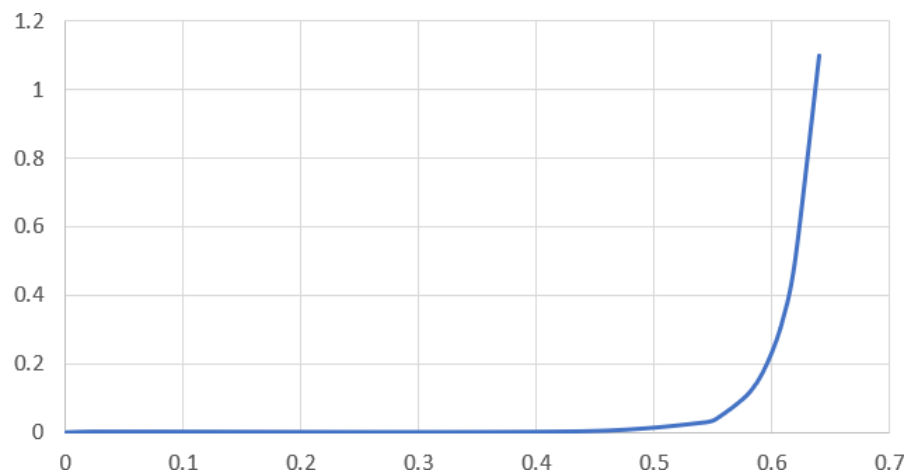


Figure 5: I_c vs V_{BE}

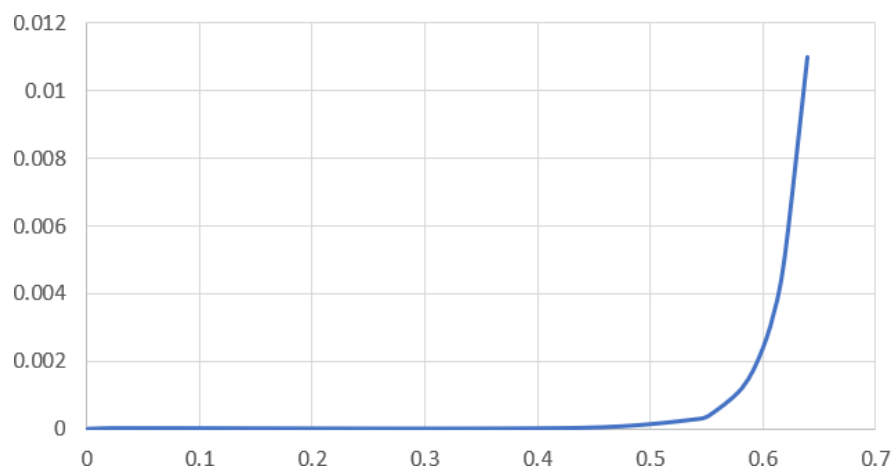


Figure 6: I_b vs V_{BE}

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

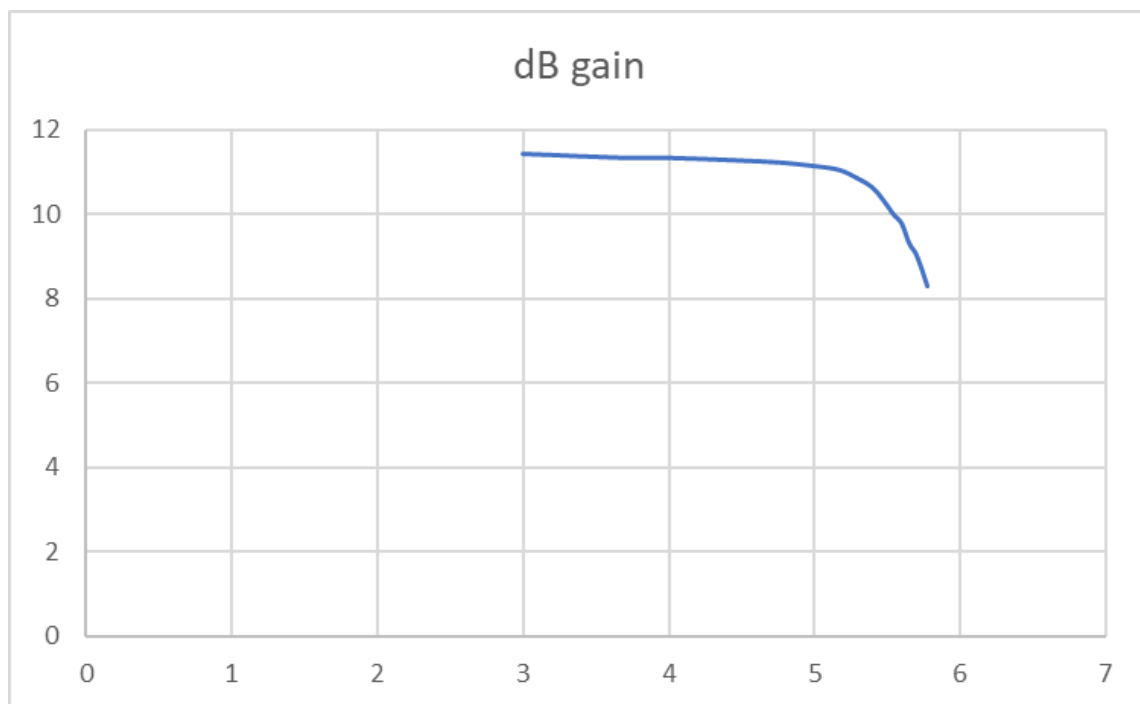


Figure 7: gain vs log(input freq)

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