EE236 : Electronic Devices Lab
Lab 5 [Tuesday Batch]

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1 Aim of The Experiment

1. To analyze the output characteristics of BJT in Common Base configuration and determine Base transport factor (α) and Common Emitter Current Gain (β)

2. To plot and analyze the frequency response of BJT and HBT in Common Emitter configuration

2 Part 1: BJT Parameters in CB configuration
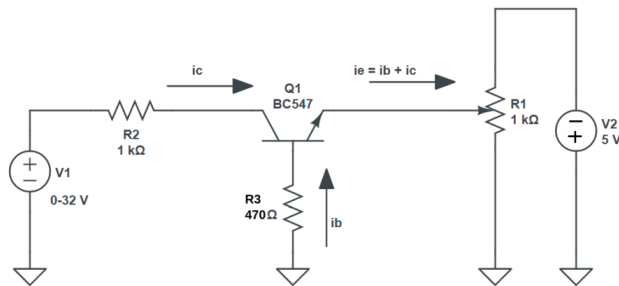
2.1 Circuit Design
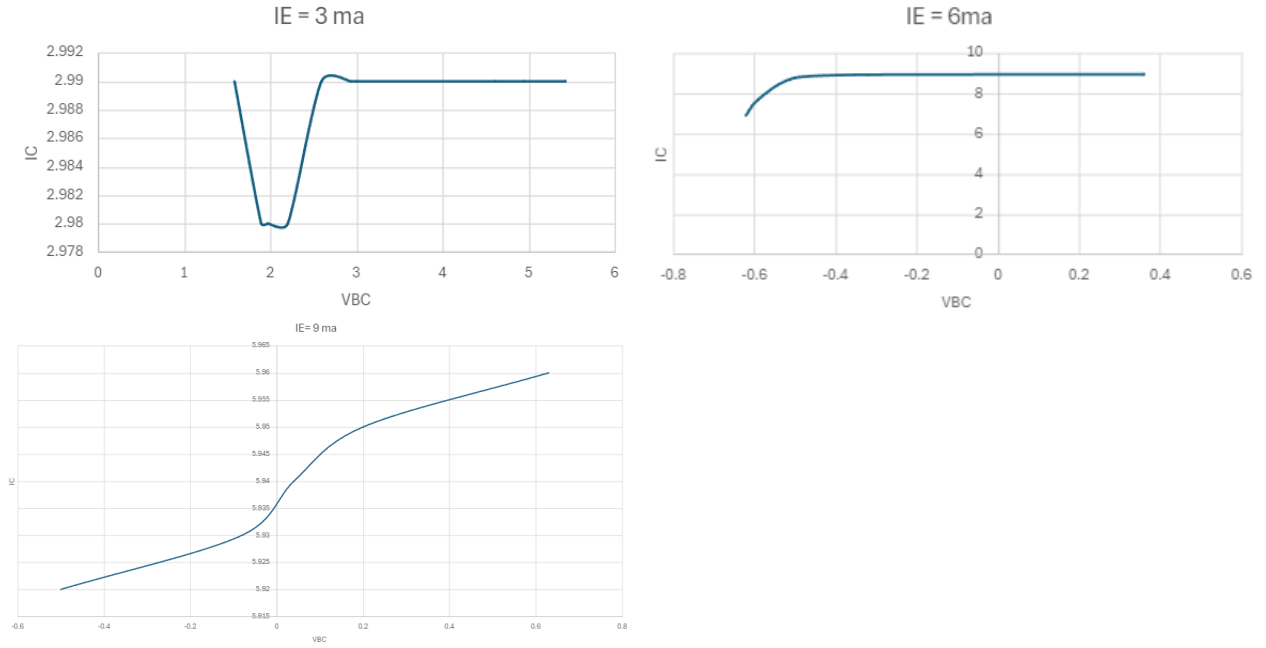

Figure 1: CB Circuit

2.2   Plots of I_C vs V_{BC}

Figure 2: I_C vs V_{BC}

2.3 α and β Table

$$I_{C,\text{avg}} = \frac{1}{N} \sum_{i=1}^{N} I_{C,i}$$

$$I_{B,\text{avg}} = I_E - I_{C,\text{avg}}$$

$$\alpha = \frac{I_{C,\text{avg}}}{I_E}$$

$$\beta = \frac{I_{C,\text{avg}}}{I_{B,\text{avg}}}$$

	IE $=$ 3mA	IE $=$ 6mA	IE $=$ 9mA
Alpha	0.99666667	0.99333333	0.99666667
Beta	299	149	299

$$\alpha_{\text{avg}} = \frac{1}{3} \sum_{j=1}^{3} \alpha_j = \frac{0.99666667 + 0.99333333 + 0.99666667}{3} \approx 0.9955555567$$

$$\beta_{\text{avg}} = \frac{1}{3} \sum_{j=1}^{3} \beta_j = \frac{229 + 149 + 299}{3} \approx 225.6667$$

2.4 Variation of I_C and I_E with V_{BE}
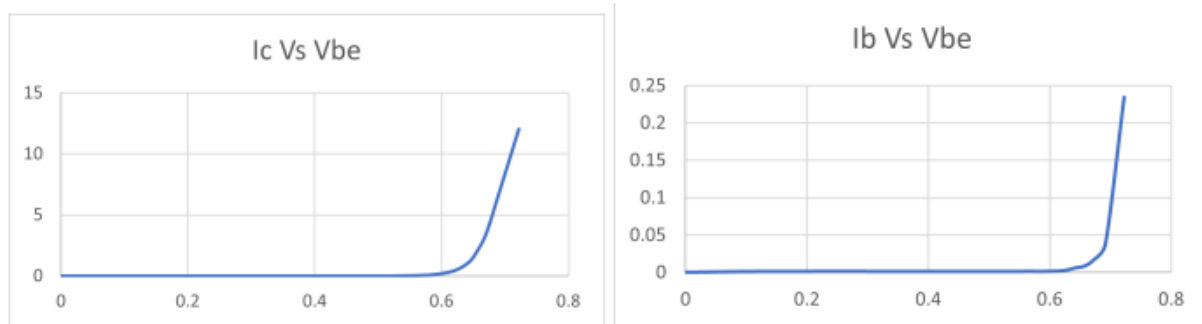
3 Part 2: Frequency response of BJT vs HBT
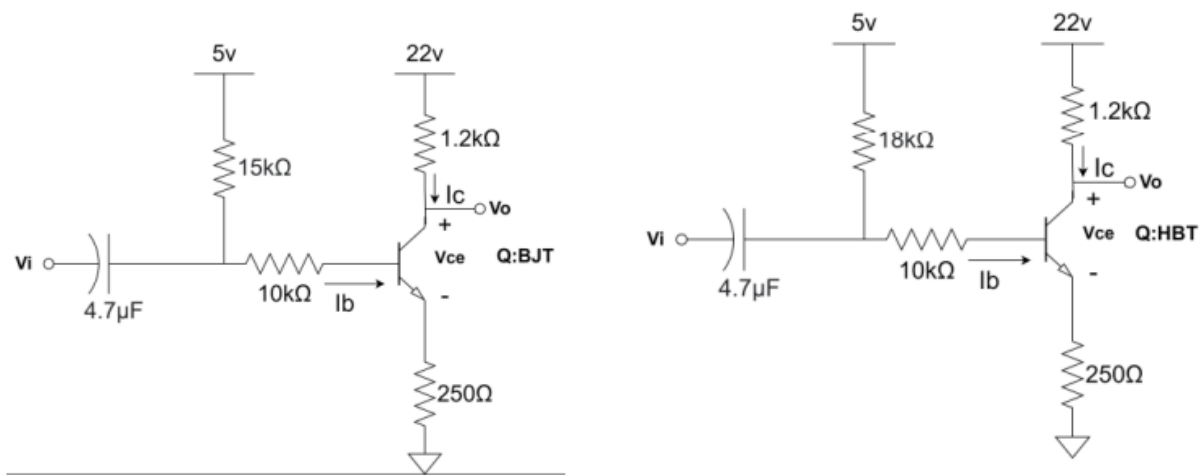
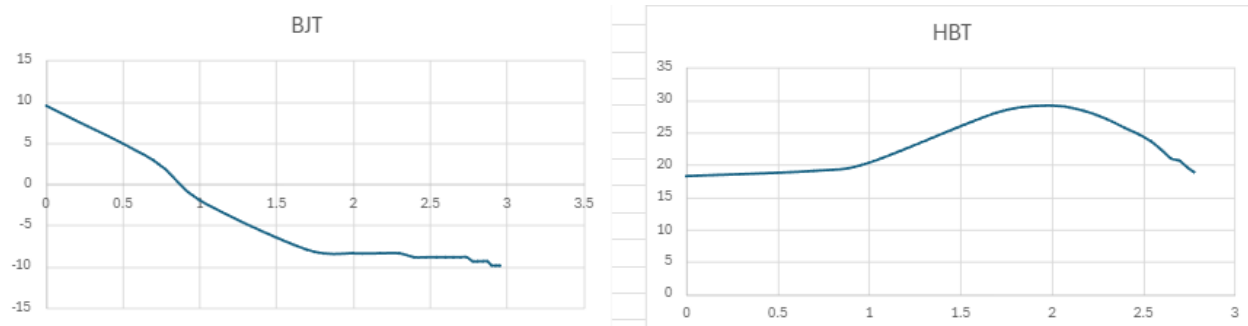### 3.1 Circuit Design

Figure 3: Circuits

3.2   Gain vs Frequency Plots

Figure 4: Gain vs Frequency

3.3   3-dB cutoff frequency

Type	3dB Cutoff Frequency
BJT	2.812kHz
HBT	233.7kHz

3.4   Superiority of HBT over BJT

Superior Performance of HBT over BJT is due to:

- Thinner base, reducing carrier transit time and increasing speed whereas BJT has thicker base

- HBT is made up of high mobility materials like GaAs. Thus it has fast carrier movement compared to BJT (Si)