$20 \log_{10} |A_V| = A_{V\,dB}$

$20 \log_{10} |A_I| = A_{I\,dB}$

$10 \log_{10} A_P = A_{P\,dB}$

$\log_{10}(1) = 0$

$\log_{10}(10) = 1$

$\log_{10}(10^x) = x$

$\log_{10}(2) = 0.3$

$\log(a.b) = \log a + \log b$

A_V or A_I (A_P)	$A_{V\,dB}$ or $A_{I\,dB} = 20\log_{10} A_V$ or $20\log_{10} A_I$	$A_{P\,dB} = 10\log_{10} A_P$
$1/\sqrt{2} = 0.707$	-3	-1.5
$\sqrt{2} = 1.414$	$+3$	$+1.5$
2	$+6$	$+3$
$4 = 2^2$	12	6
10	20	10
20	26	13
$100 = 10^2$	40	20
200	46	26
$1000 = 10^3$	60	30
$10\,000 = 10^4$	80	40
$100\,000 = 10^5$	100	50

NOTE

When dB values are given Ratio values can be obtained as follows.

$A_{V\,dB} = 20\log_{10} A_V \Rightarrow A_V = 10^{A_{V\,dB}/20}$

$A_{I\,dB} = 20\log_{10} A_I \Rightarrow A_I = 10^{A_{I\,dB}/20}$

$A_{P\,dB} = 10\log_{10} A_P \Rightarrow A_P = 10^{A_{P\,dB}/10}$

Ex. 1/. If $A_{V\,dB} = 83\ dB = 80\ dB + 3\ dB$

then $A_V = 10^{(83/20)} = 10^4 \times 1.414 = 14140$ //

2/. If $A_{P\,dB} = 33\ dB = 30\ dB + 3\ dB$

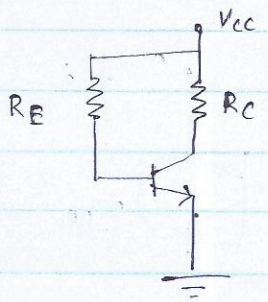
$A_P = 10^{33/10} = 10^{3.3} = 10^3 \times 2 = 2000$ //

BJT Amp. Circuits

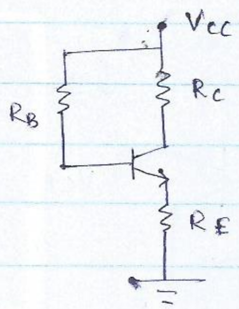
\# chapter 5

BJT AC Analysis.

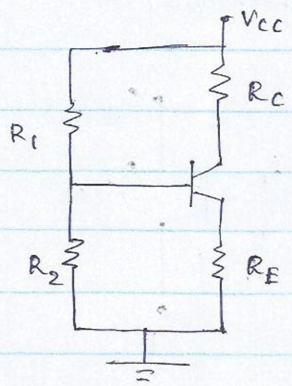
Note : BJT DC Analysis (Biasing circuits) } Covered in Sem III Electronics I



① Fixed Bias cct.



② Fixed Bias cct. with emitter res.



③ Potential Divider Biasing cct.

* Best Biasing cct → ③
* Worst " " → ①

BJT AC Models (Equivalent ccts.)

(1). r_e model (Simplified model). (2 parameter model) → r_e, β (α)

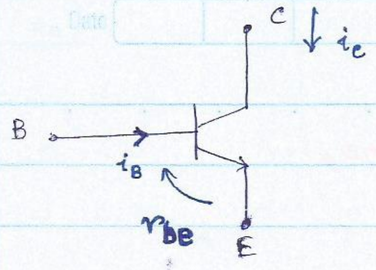
(2). Hybrid model.

→ hybrid parameter (h-parameter) model (4 parameter model) → h_i, h_f, h_r, h_o

→ hybrid - π model (much more than 4 para.)

For law to mid freq. Range (→ r_e model, hybrid parameter model)

used for high freq. analysis & design (→ hybrid - π model)

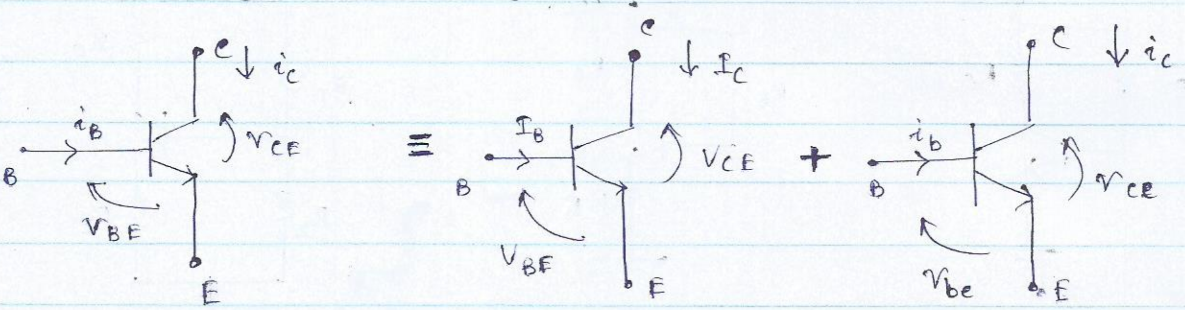


V_{BE} = DC BE Voltage
v_{be} = AC instantaneous BE vol.
v_{BE} = Total BE vol.
V_{be} = RMS BE vol. (of the ac quantities)
V_{bep} or V_{bem} = Peak or Maximum BE Voltage (ac quantity)

In a BJT amp. cct.

$$v_{BE}(t) = V_{BE} + v_{be}(t)$$

- $v_{BE}(t)$: Total BE voltage (instantaneous value)
- V_{BE}: DC BE voltage (DC bias voltage)
- $v_{be}(t)$: instantaneous ac vol.



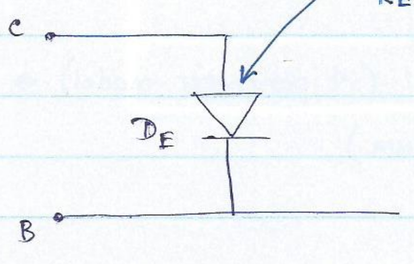
Total (DC + AC)

DC → DC Analysis to find Q point.
(I_B, I_C, V_{BE}, V_{CE})
(DC Models) or Load lines (DCLL)

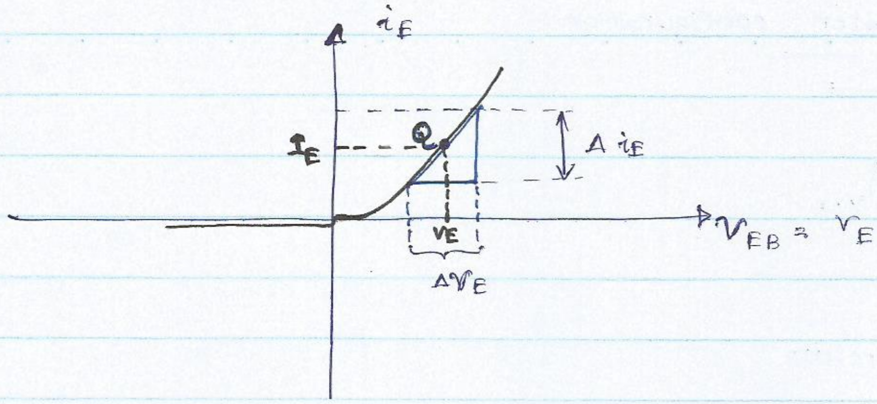
AC → AC Analysis to find gains / amplifications, I/P, O/P, Imp, BW.
(AC Models) or Load lines (ACLL)
AC Models: r_e model, h-para model

r_e model

r_e - AC resistance
R_E - DC resistance



$$R_E = \frac{V_E}{I_E}$$



$$R_E = \frac{V_E}{I_E}$$

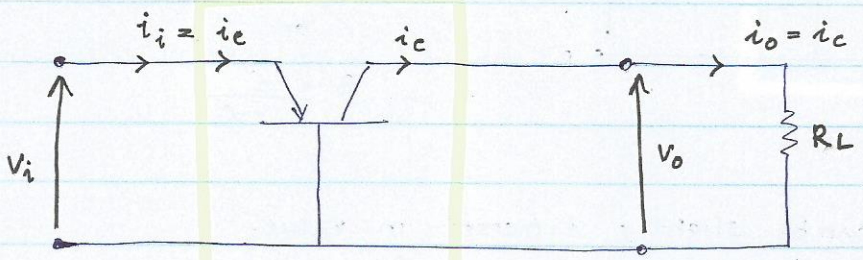
$$r_e = \frac{\Delta V_E}{\Delta i_E}$$

NOTE : From diode lecture (ET 2001)

$$r_e \simeq \frac{V_T}{I_E} = \frac{26\ mV}{I_E} \text{ at room temp.}$$

room temp. = $27^\circ C \simeq 300K$

Common Base Configuration.



$$A_v = \frac{v_o}{v_i}$$

$$v_o = i_o R_L = i_c R_L$$

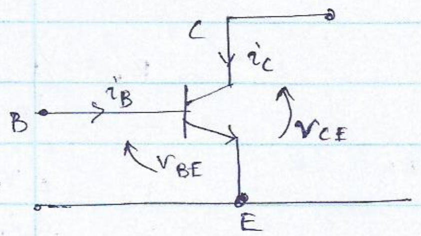
$$i_c = \alpha i_e$$

$$v_o = \alpha i_e R_L$$

$$v_i = i_e r_e$$

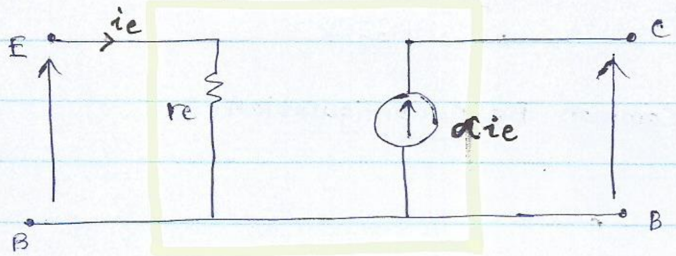
$$A_v = \frac{\alpha R_L}{r_e}$$

Common Emitter configuration.



Total circuit

re model for Common Base.



$$\alpha = \frac{\beta}{\beta+1}$$

or

$$\beta = \frac{\alpha}{1-\alpha}$$

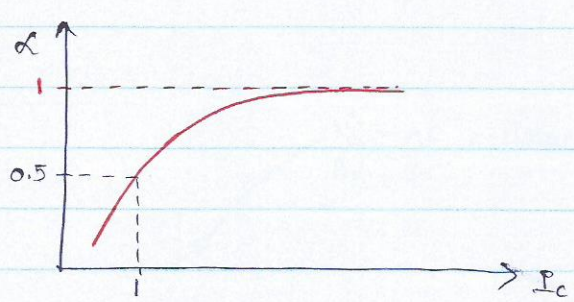
Note. ① → α_{dc} and α_{ac} can be slightly different in value.

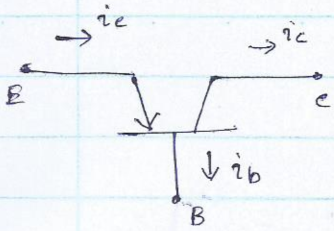
→ It is common to assume $\alpha_{dc} \simeq \alpha_{ac}$ when they are not given explicitely.

$\therefore \alpha_{DC} \simeq \alpha_{ac} \simeq \alpha$ } commo symbol for α

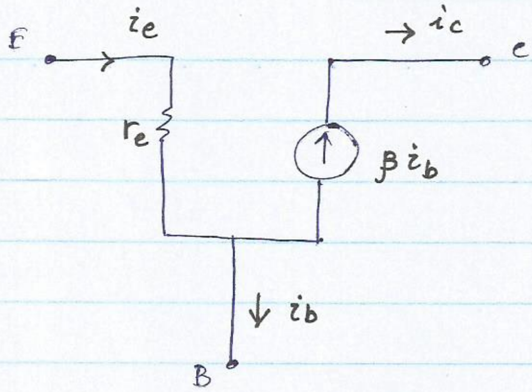
②. Same argument is applicable for β as well.

③. Usually α various with I_c





pnp trans.



$$\alpha i_e \simeq \beta i_b$$

Question.

Draw CE and CC Eq. ccts using r_e, β as parameters. This require redrawing the Eq. ccts with,

E as common – CE

C as common – CC

Repeat for a npn BJT.