Navlakhi®

Chapter 1

BJT DC

[Classwork Supplement]

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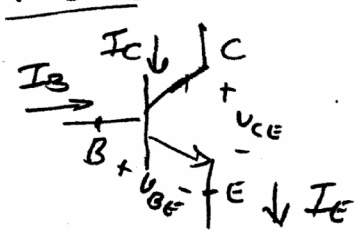
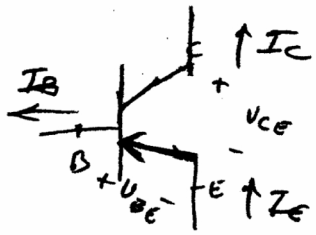
BJT PREREQUISITES

SYMBOL :



n-p-n



p-n-p

$I_E = I_C + I_B = (1+\beta) I_B$

$I_C = \beta I_B$ $\quad I_C = \alpha I_E$

	Input	Output	Q
Common Emitter	Base	Collector	(V_{CE}, I_C)
Common Collector	Base	Emitter	(V_{CE}, I_C)
Common Base	Emitter	Collector	(V_{CB}, I_C)

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

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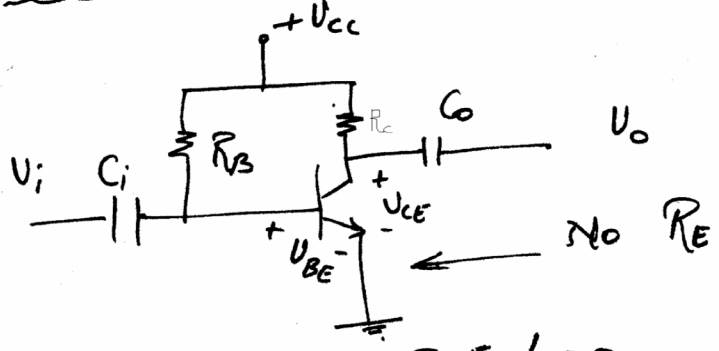
BJT BIASING

TYPE I : FIXED-BIAS



Applying KVL to B-E loop

$$V_{CC} - V_{BE} = I_B R_B$$

$$\therefore \boxed{I_B = \frac{V_{CC} - V_{BE}}{R_B}}$$

$$I_C = \beta I_B = \text{\_\_\_\_\_}$$

Applying KVL to CE loop

$$V_{CC} - V_{CE} = I_C R_C$$

$$\therefore \boxed{V_{CE} = V_{CC} - I_C R_C}$$

$$Q \equiv (V_{CE_Q}, I_{C_Q})$$

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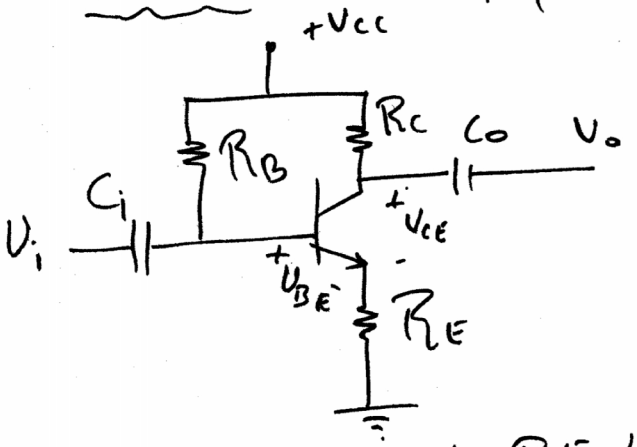
TYPE II : EMITTER STABILIZED BIAS



Applying KVL to BE loop

$$V_{CC} - V_{BE} = I_B R_B + I_E R_E$$

$$V_{CC} - V_{BE} = I_B R_B + (1+\beta) I_B R_E$$

$$V_{CC} - V_{BE} = I_B [R_B + (1+\beta) R_E]$$

$$\boxed{I_B = \frac{V_{CC} - V_{BE}}{R_B + (1+\beta) R_E}}$$

$$I_C = \beta I_B = \_\_\_\_$$

Applying KVL to CE loop

$$V_{CC} - V_{CE} = I_C R_C + I_E R_E$$

$$\boxed{V_{CE} = V_{CC} - I_C R_C - I_E R_E}$$

$$Q \equiv (V_{CEQ}, I_{CQ})$$

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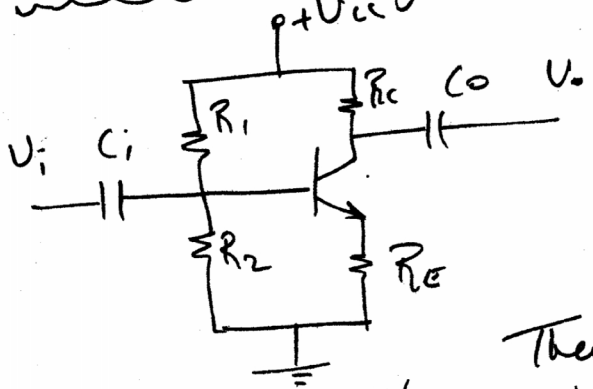
TYPE III : Voltage Divider Bias.



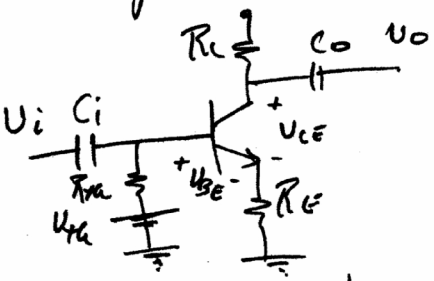
Applying KVL to B-E loop

$V_{TH} - V_{BE} = I_B R_{TH} + I_E R_E$

$V_{TH} - V_{BE} = I_B [R_{TH} + (1+\beta) R_E]$

$$I_B = \frac{V_{TH} - V_{BE}}{R_{TH} + (1+\beta) R_E}$$

Thevenising the ckt we get :



$$V_{TH} = \frac{R_2}{R_1 + R_2} V_{cc}$$

$I_C = \beta I_B =$ _____

Applying KVL to C-E loop

$V_{cc} - V_{CE} = I_C R_C + I_E R_E$

$$V_{CE} = V_{cc} - I_C R_C - I_E R_E$$

$Q \equiv (V_{CEQ}, I_{CQ})$

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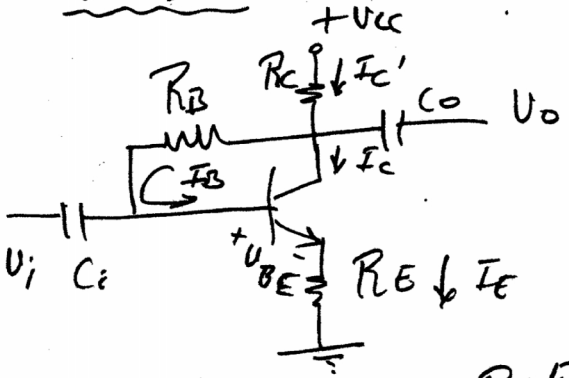
TYPE IV : DC BIAS WITH VOLTAGE FEEDBACK



$I_C' = I_C + I_B$

Applying KVL to B-E loop

$V_{cc} - V_{BE} = I_C' R_C + I_B R_B + I_E R_E$

$V_{cc} - V_{BE} = (1+\beta) I_B R_C + I_B R_B + (1+\beta) I_B R_E$

$$I_B = \frac{V_{cc} - V_{BE}}{R_B + (1+\beta)(R_C + R_E)}$$

$I_C = \beta I_B =$

Applying KVL to CE loop

$V_{cc} - V_{CE} = I_C' R_C + I_E R_E$

$$V_{CE} = V_{cc} - I_C' R_C - I_E R_E$$

$Q \equiv (V_{CE}, I_{CQ})$

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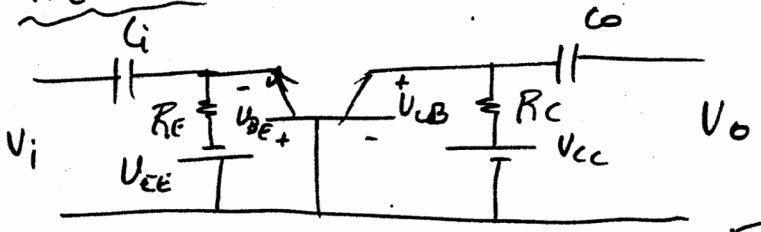
TYPE D : COMMON BASE



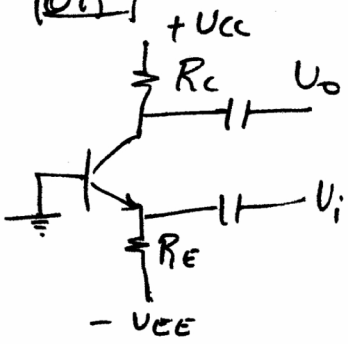
Applying KVL to B-E loop

$$V_{EE} - V_{BE} = I_E R_E$$

$$\boxed{I_E = \frac{V_{EE} - V_{BE}}{R_E}}$$

$$I_C = \alpha I_E = \text{——}$$

OR



Applying KVL to C-B loop

$$V_{CC} - V_{CB} = I_C R_C$$

$$\boxed{V_{CB} = V_{CC} - I_C R_C}$$

$$Q \equiv (V_{CB_Q}, I_{C_Q})$$