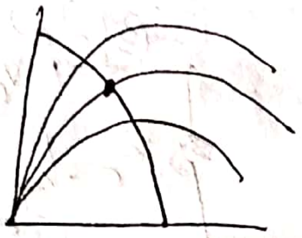
Transistor Biasing

01. 01. 2020

27



parameter variation

$\alpha = 0.98 / 0.99$

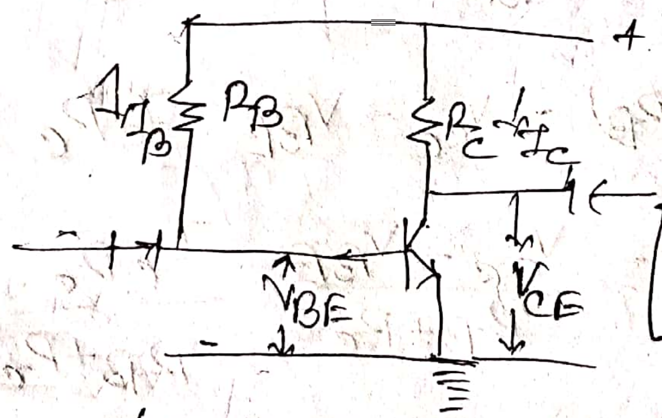
$\beta = 49 / 99$

$T \uparrow I_{CBO} \uparrow I_C \uparrow T$

stability factor, $S = \frac{\delta I_C}{\delta I_{CBO}}$

$\boxed{\text{S বাড়লে circuit birnt out হয়}}$

fixed biasing circuit



$\boxed{V_{BE} = 0.7 \text{ (around)}}$

capacitance impedence

$$X_C = \frac{1}{2\pi f C}$$

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

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

we know,

$$I_C = \beta I_B + (1+\beta) I_{CBO}$$

$$= \beta \left(\frac{V_{CC} - V_{BE}}{R_B} \right) + (1+\beta) I_{CBO}$$

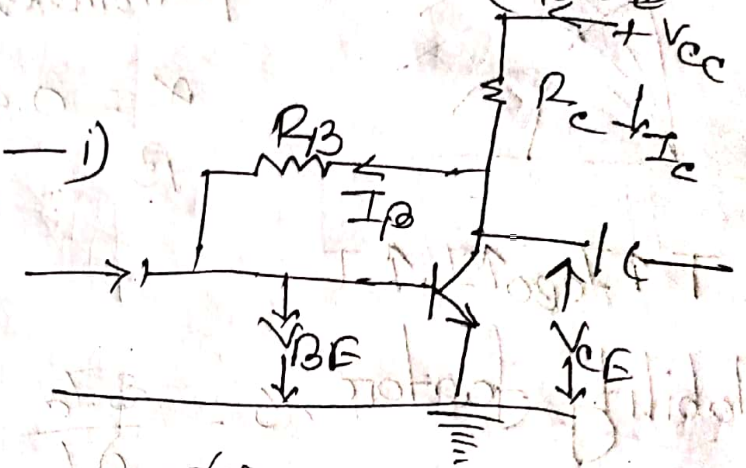
$$\Rightarrow \frac{\delta I_C}{\delta I_{CBO}} = 0 + (1+\beta)$$

$$I_C = \beta I_B + (1+\beta) I_{CBO}$$

$I_{CBO}\uparrow$ $I_B\downarrow$ I_C 28

stability biase

collector to base



$$V_{CE} = V_{BE} + I_B R_B \quad \text{—(i)}$$

$$(I_B+I_C) R_C + V_{CE} = V_{CC} \quad \text{—(ii)}$$

$$(I_B+I_C) R_C + V_{BE} + I_B R_B = V_{CC}$$

$$\Rightarrow I_B (R_C+R_B) = V_{CC} - V_{BE} - I_C R_C$$

$$\Rightarrow I_B = \frac{V_{CC}-V_{BE}}{R_B+R_C} - \frac{I_C R_C}{R_B+R_C}$$

we know,

$$I_C = \beta I_B + (1+\beta) I_{CBO}$$

$$I_C = \beta\left(\frac{V_{CC}-V_{BE}}{R_B+R_C} - \frac{I_C R_C}{R_B+R_C}\right) + (1+\beta) I_{CBO}$$

$$\Rightarrow I_C\left(1+\frac{\beta R_C}{R_B+R_C}\right) = \beta \cdot \frac{V_{C}-V_{BE}}{R_B+R_C} + (1+\beta) I_{CBO}$$

Scanned with CamScanner

~~if one side of semiconductor~~

~~if one side of a single crystal is dopped~~

~~$V_0 = \frac{KT}{q}\log\left(\frac{N_A N_D}{n_i^2}\right)$~~

$$\Rightarrow \frac{\delta I_C}{\delta I_{CBO}}\left(1+\frac{\beta R_C}{R_B+R_C}\right) = 1+\beta$$

$$\Rightarrow S = \frac{\delta I_C}{\delta I_{CBO}} = \frac{1+\beta}{1+\frac{\beta R_C}{R_B+R_C}}$$

$$\boxed{S = \frac{1+\beta}{1+\frac{\beta}{1+R_B/R_C}}}$$

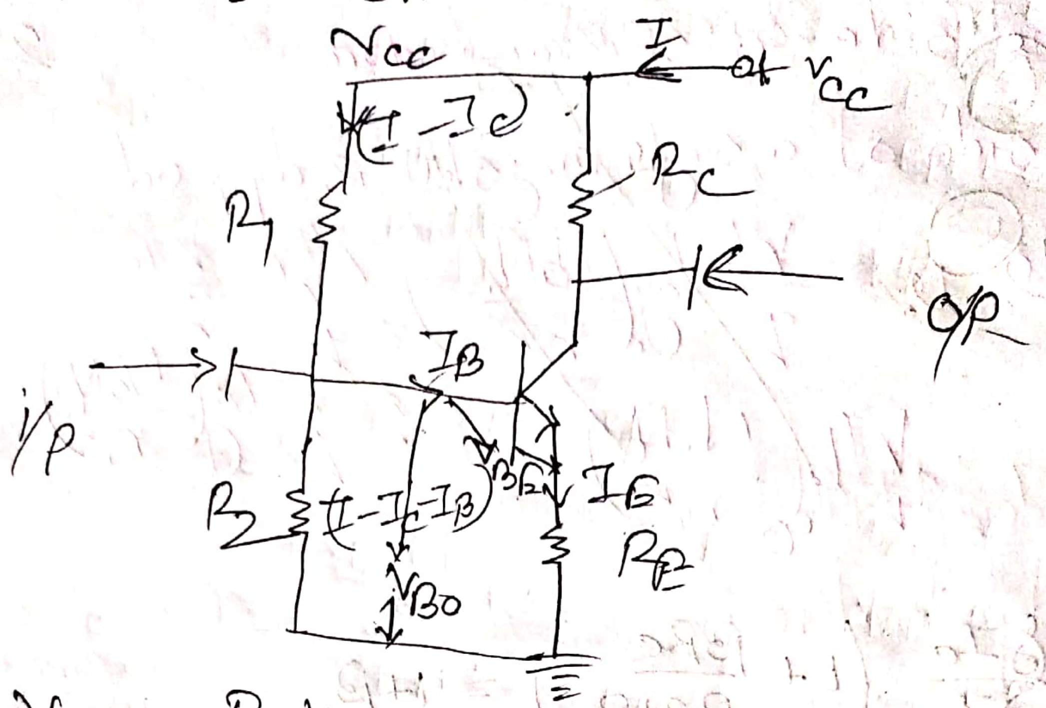
if $R_B << R_C$

$R_B/R_C << 1$ $\therefore S = \frac{1+\beta}{1+\beta} = 1$

stability বাড়লে circuit poor

stability কমলে circuit ভাল

potential devider bias or ammeter bias:



$$V_{BO} = \frac{R_2 V_{CC}}{R_1+R_2} \quad \text{—— i)}$$

$$V_{BO} = V_{BE} + I_E R_E$$

$$\Rightarrow V_{BE} = V_{BO} - I_E R_E \quad \text{—— ii)}$$

$$V_{BO} = (I - I_C - I_B) R_2$$

$$= (I - I_C) R_2 - I_B R_2 \quad \text{—— iii)}$$

$$V_{CC} = (I - I_C) R_1 + (I - I_C - I_B) R_2$$

$$V_{CC} + I_B R_2 = (I - I_C)(R_1 + R_2)$$

$$\Rightarrow I - I_C = \frac{V_{CC} + I_B R_2}{R_1 + R_2} \quad \text{—— iv)}$$

iii) $\Rightarrow$

$$V_{BO} = \frac{V_{cc} + I_B R_2}{R_1 + R_2} R_2 - I_B R_2$$

$$= \frac{V_{cc} R_2 + \cancel{I_B R_2^2} - I_B R_1 R_2 - \cancel{I_B R_2^2}}{R_1 + R_2}$$

$$V_{BO} = \frac{(V_{cc} - I_B R_1) R_2}{R_1 + R_2}$$

$$V_{BO} = \frac{V_{cc} R_2}{R_1 + R_2} - \frac{I_B R_1 R_2}{R_1 + R_2} \longrightarrow \text{v)}$$

ii) $\Rightarrow$

$$V_{BE} = \frac{V_{cc} R_c}{R_1 + R_2} - \frac{I_B R_1 R_2}{R_1 + R_2} - I_E R_E$$

$$\Rightarrow V_{BE} = \frac{V_{cc} R_c}{R_1 + R_2} - I_B \frac{R_1 R_2}{R_1 + R_2} - I_C R_E - I_B R_E$$

$[\because I_E = I_C + I_B]$

$$\Rightarrow V_{BE} - \frac{V_{cc} R_c}{R_1 + R_2} + I_C R_E = - I_B \left(\frac{R_1 R_2}{R_1 + R_2} + R_E \right)$$

$$\Rightarrow I_B = \frac{\frac{V_{cc} R_c}{R_1 + R_2} - V_{BE} - I_C R_E}{\left(\frac{R_1 R_2}{R_1 + R_2} + R_E \right)}$$

$$\Rightarrow I_B = \frac{\frac{V_{CC} R_2}{R_1+R_2} - V_{BE}}{\frac{R_1 R_2}{R_1+R_2} + R_E} - \frac{I_C R_E}{\frac{R_1 R_2}{R_1+R_2} + R_E} \quad \text{---(vi)}$$

$$\therefore I_C = I_B \beta + (1+\beta) I_{CBO}$$

$$\Rightarrow I_C = \beta \left[\frac{V_{CC}\frac{R_2}{R_1+R_2} - V_{BE}}{\frac{R_1 R_2}{R_1+R_2} + R_E} - \frac{I_C R_E}{\frac{R_1 R_2}{R_1+R_2} + R_E} \right] + (1+\beta) I_{CBO}$$

$$\Rightarrow I_C \left(1 + \beta \cdot \frac{R_E}{\frac{R_1 R_2}{R_1+R_2} + R_E}\right) = \beta \left(\frac{V_{CC}\frac{R_2}{R_1+R_2} - V_{BE}}{\frac{R_1 R_2}{R_1+R_2} + R_E} \right) + (1+\beta) I_{CBO} \left(\frac{R_1 R_2}{R_1+R_2}\right)$$

$$\Rightarrow \frac{\delta I_C}{\delta I_{CBO}} = \frac{1+\beta}{1+\beta \frac{R_E}{\frac{R_1 R_2}{R_1+R_2} + R_E}}$$

$$I_C = \beta \left(\frac{\frac{V_{CC}R_2}{R_1+R_2} - V_{BE} - I_C R_E}{\left(\frac{R_1R_2}{R_1+R_2} + R_E\right)} \right) + (1+\beta) I_{CBO}$$

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$$= \frac{\beta \left(V_C \right.}{\frac{R_1R_2}{R_1+R_2} + R_E}$$

$$\frac{\delta I_C}{\delta I_{CBO}} = \frac{R_E + \frac{R_1R_2}{R_1+R_2}}{R_E + \left(\frac{1}{\beta+1}\right)\frac{R_1R_2}{R_1R_2}}$$

$$\left[1+\beta = 51 \right]$$

$$\frac{1}{1+\beta} = 0.02$$

exam - মঙ্গলবার - ২০ তারিখ

Repal factor, full wave ractifire.

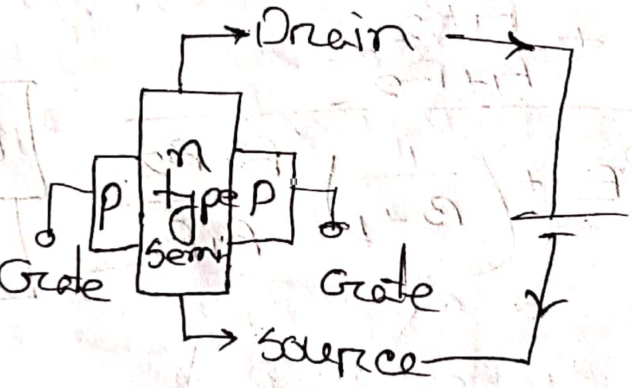
05-01-2020

Field Effect Transistor (FET) 34-

Junction FET | Mos FET

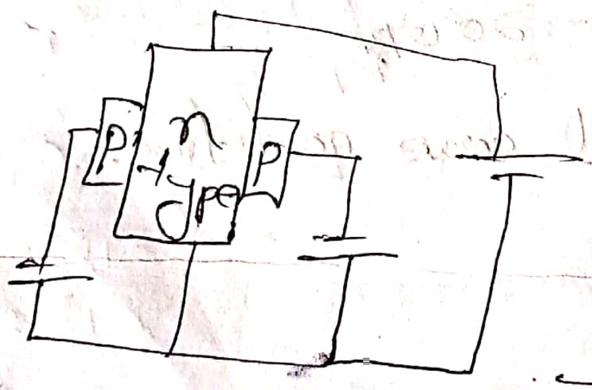
n-chenel J-FET | p-chennel J-FET

n-chennel J-FET

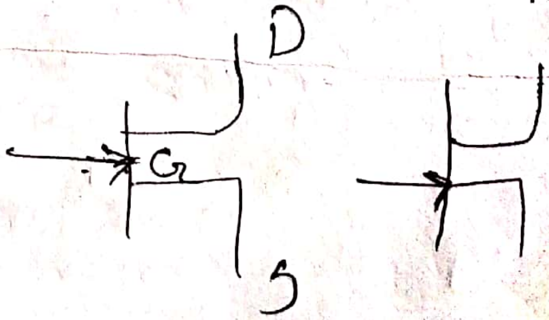


chennel doped হয় lightly

gate doped হয় heavily

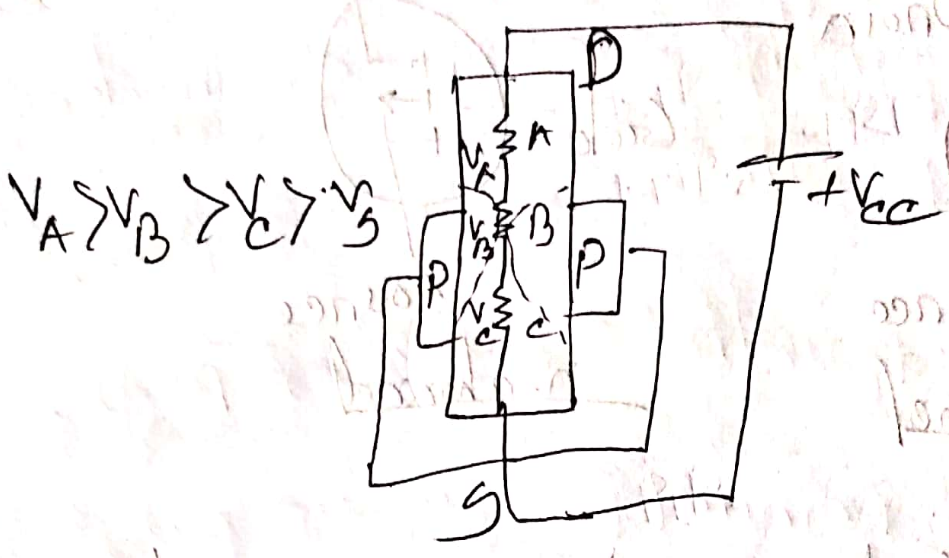


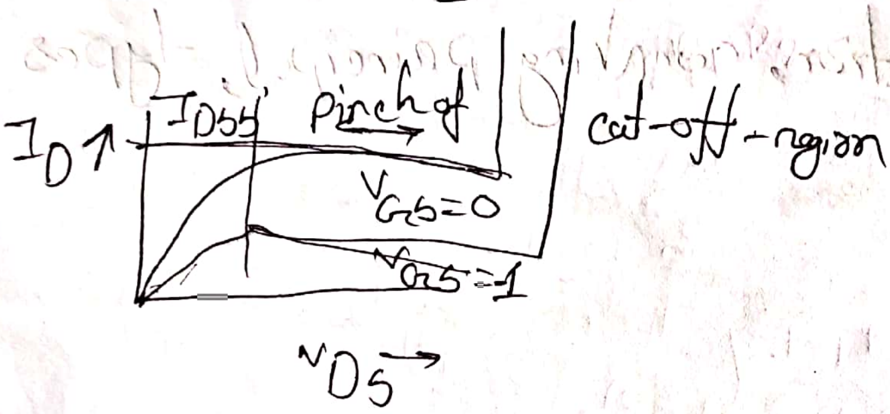
Gate কে reverse biase এ রাখতে হয়



p-type bel দিয়ে বন্ধ থাকে

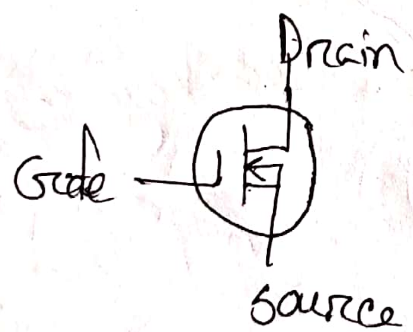
35





যে voltage এর জন্য current শূন্য হয়-সেই voltage কে pinch off voltage বলে।

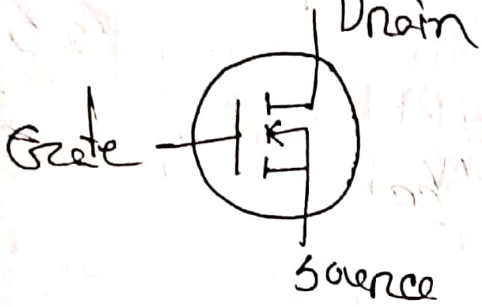
mosfet ২ two types.



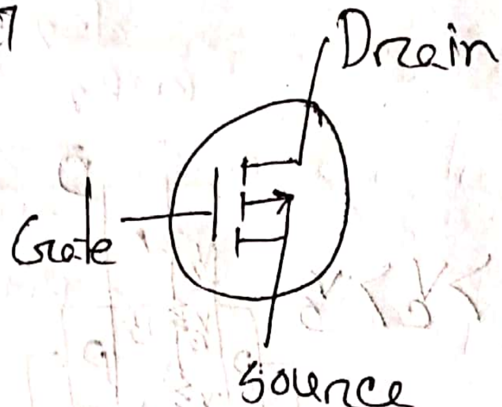
n-chennel

Enhancement-mode mosfet (E-MOSFET)

Symbol - of E-MOSFET

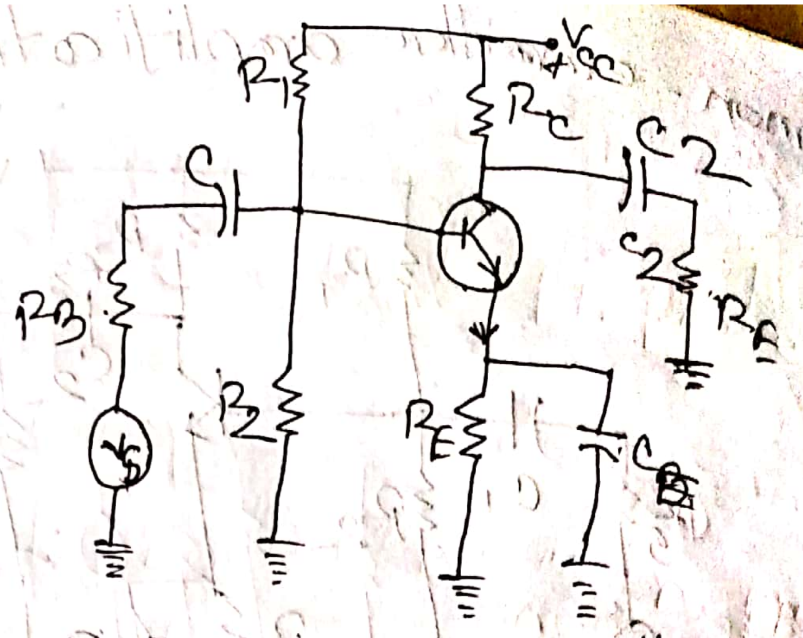


p-channel



n-channel

fet, classification, working principal, types of fet, curve



Common-emitter

transistor amplifier.

$V_i = h_i I_i + h_f V_o$ — input

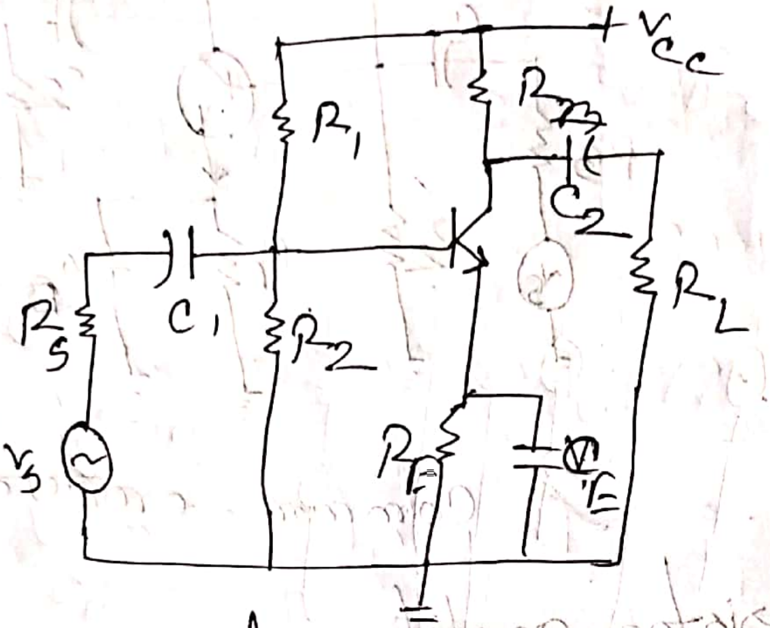
$I_o = h_f I_i + h_o V_o$ — output

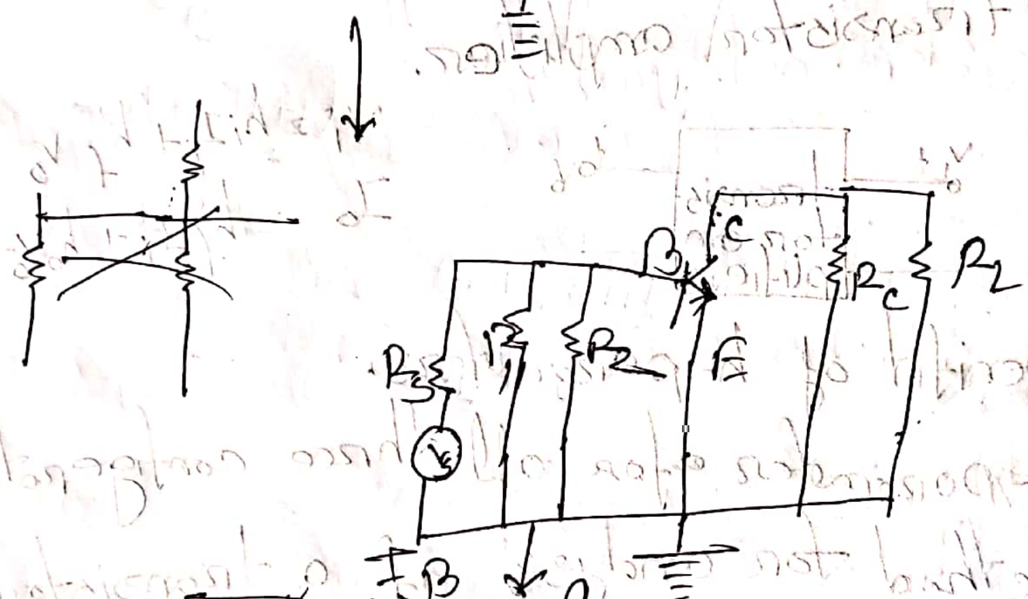
Benifit of h-parameters.

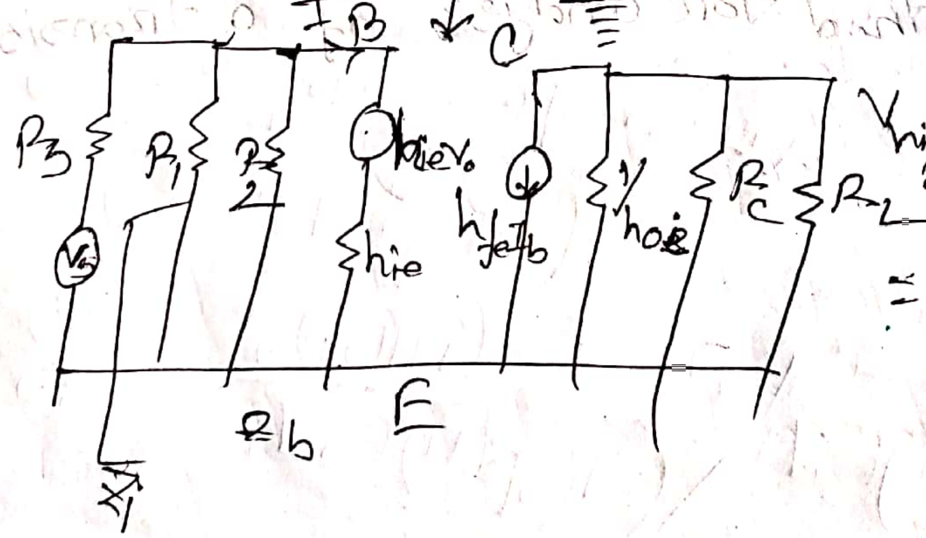
h-parameter for all three configeration

method for analysis of a transistor circuit

common-emitter amplification







$V_{hie} + V_o h_{re} \cong V_{hie}$

$= I_b h_{ie}$

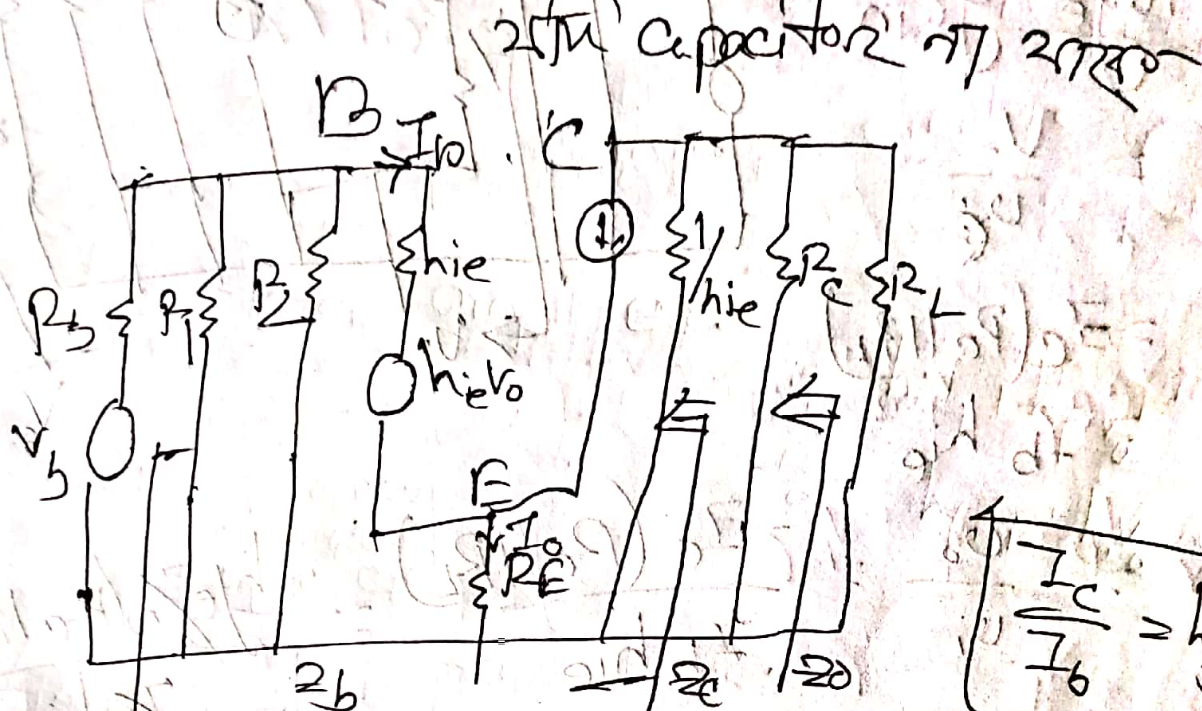
small

input impedence

$$z_b = \frac{h_{ie} I_b}{I_b}$$

$$= h_{ie}$$

$$Z_b = R_1 \| R_2 \| R_{hie}$$



$$\frac{I_c}{I_b} = h_{fe}$$

$$V_i = I_b h_{ie} + R_e(I_b + I_c)$$

$$= I_b h_{ie} + R_e I_b + R_e h_{fe} I_b$$

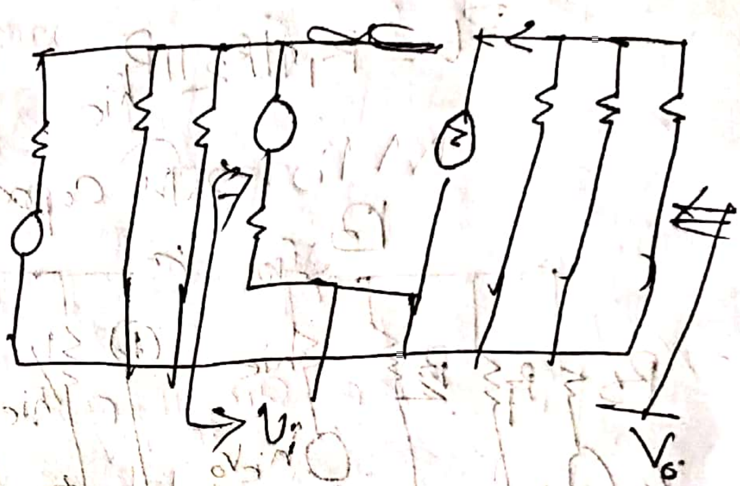
$$V_i = I_b\left(h_{ie} + (1 + h_{fe}) R_E\right)$$

$$\Rightarrow z_b = \frac{V_i}{I_b} = h_{ie} + (1 + h_{fe}) R_E$$

Output impedence

$$Z_c = \frac{1}{h_{oe}} \qquad Z_o = Z_c \| R_C$$

~~Current gain~~



voltage gain

$$A_v = \frac{V_o}{V_i}$$

$$v_o = I_c (R_c \| R_L)$$

$$v_i = I_b h_{ie}$$

$$A_v = \frac{v_o}{v_i} = \frac{-I_c (R_c \| R_L)}{I_b h_{ie}} = \frac{-h_{fe} \cancel{I_b} (R_c \| R_L)}{\cancel{I_b} h_{ie}}$$

$$= \frac{-h_{fe}(R_c \| R_L)}{h_{ie}}$$

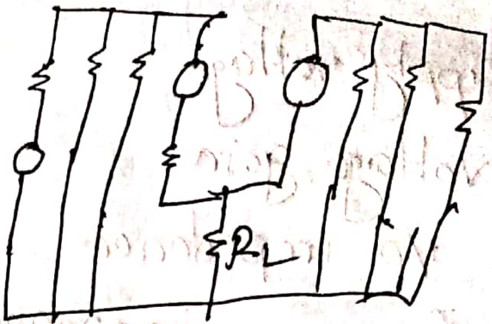
voltage gain (capacitor না থাকলে)

$$v_i = I_b (h_{ie} + (1 + h_{fe}) R_e)$$

$$\therefore A_v = \frac{v_o}{v_i} = \frac{-I_c (R_c \| R_L)}{I_b (h_{ie} + (1 + h_{fe}) R_e)} = \frac{-h_{fe} \cancel{I_b} (R_c \| R_L)}{\cancel{I_b} (h_{ie} + (1 + h_{fe}) R_E)}$$

$$= \frac{-h_{fe}(R_C \| R_L)}{(1+h_{fe}) R_E}$$

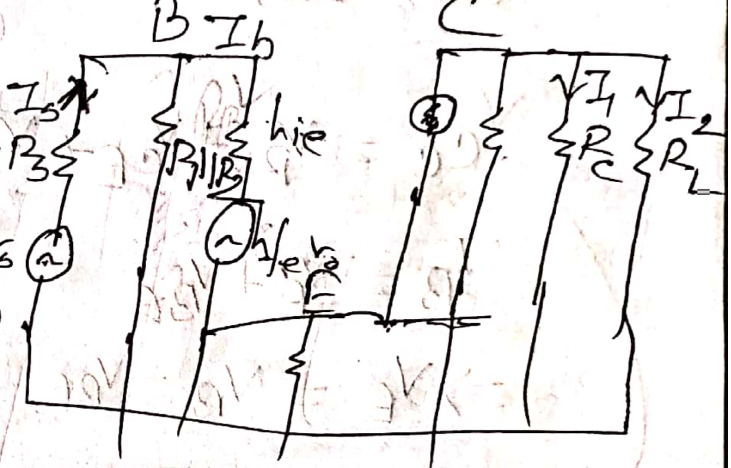
if $1+h_{fe} \gg h_{ie}$



$$\therefore A_{ve} \simeq -\frac{R_C \| R_L}{R_E}$$

$1+h_{fe} \simeq \frac{.99}{100}$

Current gain



$$h_{fe} = \frac{I_c}{I_b} \Rightarrow I_c = h_{fe} I_b$$

$$I_b = \frac{I_s \cdot R_B}{R_C + Z_b}$$

$$I_c = \frac{h_{fe} I_s R_B}{R_B + Z_b}$$

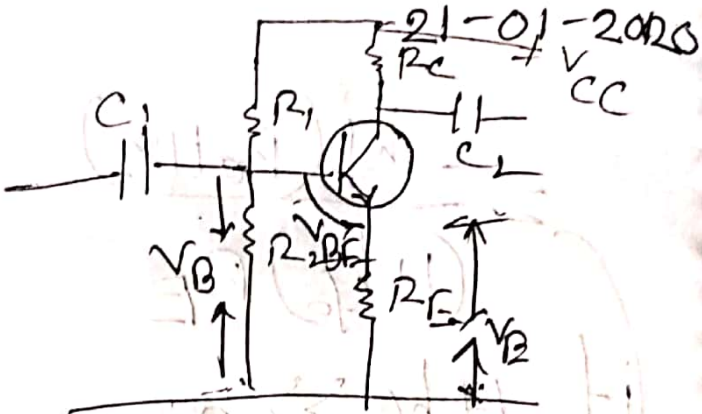
$$\Rightarrow \frac{I_c}{I_s} = \frac{h_{fe} R_B}{R_B + Z_b}$$

$$I_L = \frac{I_c \cdot R_C}{R_C + R_L}$$

$$\Rightarrow \frac{I_L}{I_s} = \frac{h_{fe} R_B \cdot R_C}{(R_L + R_C)(R_B + Z_b)}$$

Power gain

21-01-2020



supply voltage
voltage gain
i/p impedence
frequency responce

$$A_v = \frac{-h_{fe}(R_C \| R_L)}{h_{ie}}$$

$R_C \uparrow, A_v \uparrow$

$I_C \gg 500\mu A$

$$V_{CC} = V_{RC} + V_{CE} + V_{RE}$$

$\boxed{I_C \simeq I_E}$

$$V_B = V_E + V_{BE}$$

$\boxed{I_E = \frac{V_E}{R_E}}$, $I_C = \frac{V_{RC}}{R_C}$

$$\Rightarrow V_E = V_B - V_{BE}$$

$$V_{RC} = V_{CC} - \overset{5V}{V_{CE}} - \overset{3V}{V_{RE}}$$

for the good biasing stability

$$R_2 = \frac{V_B}{I_2}$$

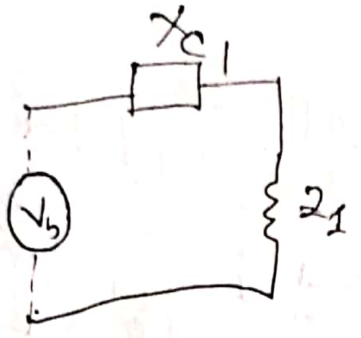
$$V_B = V_{BE} + V_{RE}$$

$$R_1 = \frac{V_{CC} - V_B}{I_1 + I_B}$$

$\boxed{V_B = 3.7V}$

$$I_2 = \frac{I_C}{10}$$

degine of del



$$X_{C_1} = \frac{Z_1}{10}$$

$$X_{C_2} = \frac{R_L}{10}$$

Bypass capacitor

$$X_C = \frac{1}{2\pi f}$$

$$A_V = \frac{-h_{fe}(R_C \| R_L)}{h_{ie} + (1+h_{fe})(R_E \| X_{C_2})}$$

$$= \frac{-h_{fe}(R_C \| R_L)}{h_{ie} + (1+h_{fe})X_{C_2}}$$

$$= \frac{-h_{fe}(R_C \| R_L)}{h_{ie} - J(1+h_{fe})X_{C_2}}$$

let, $h = (1+h_{fe})X_{C_2}$

$$= \frac{-h_{fe}(R_C \| R_L)}{\sqrt{h_{ie}^2 + \{(1+h_{fe})X_C\}^2}}$$

$$X_{C_3} = \frac{h_{ie}}{1+h_{fe}}$$

$$|A_V| = \frac{-h_{fe}(R_C \| R_L)}{h_{ie}(\sqrt{2})} \rightarrow A_V$$

$$\Rightarrow |A_V| = \frac{A_V}{\sqrt{2}}$$

h-parameter

$$h_{ie} = \frac{V_{be}}{I_B}$$

$$h_{ie} = \frac{V_{be}}{I_b}\bigg|_{V_{CE}}$$

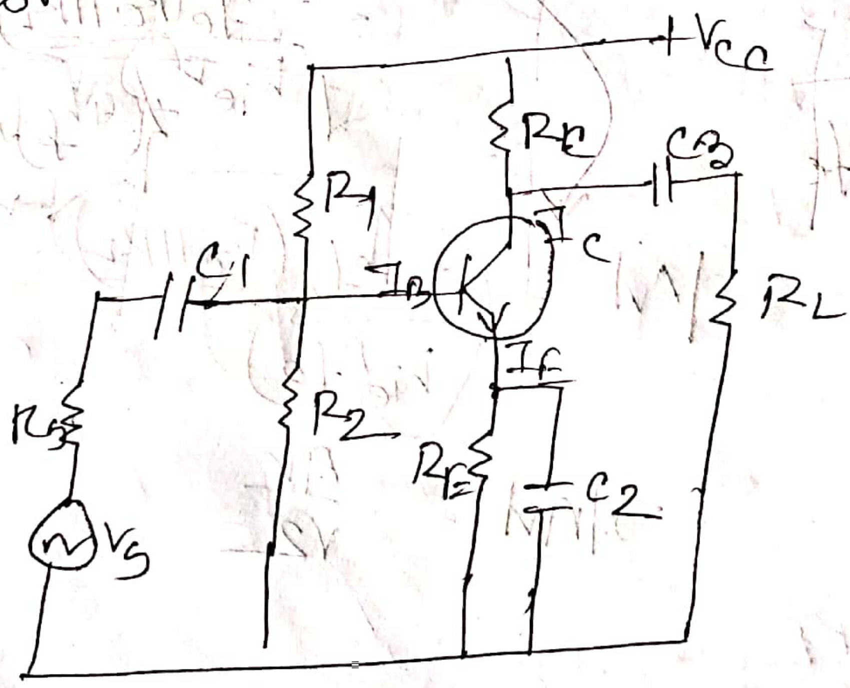
for reverse bias

$$h_{re} = \frac{\Delta V_{BE}}{\Delta V_{CE}}\bigg|_{I_B}$$

for foreward bias,

$$h_{fe} = \frac{I_c}{I_b}\bigg|_{V_{CE}}$$

Common-emitter circuit:



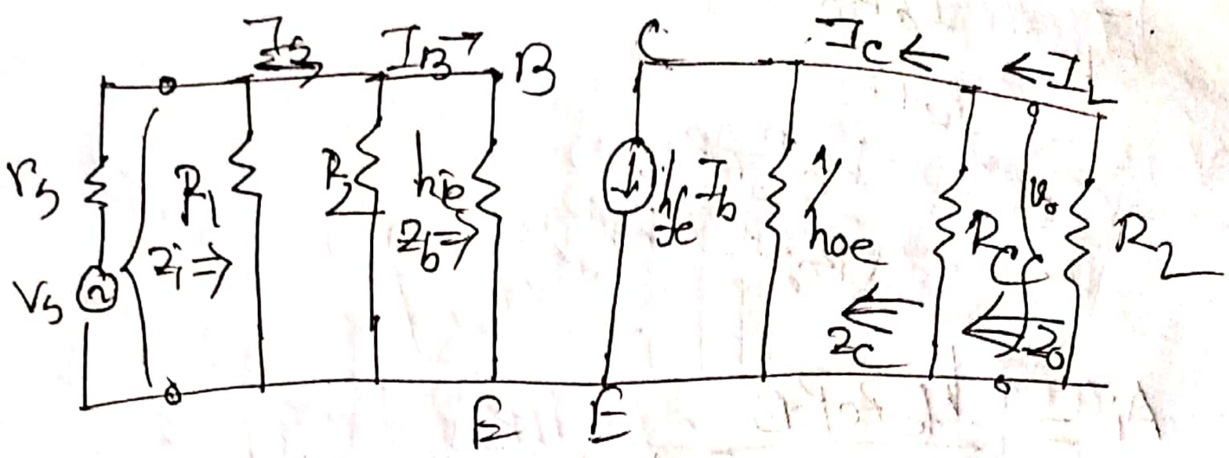


Fig: h-parameter equivalent circuit for CE circuit. (bypassed capacitor)

input impedence.

$$Z_i = R_1 \| R_2 \| Z_b$$

output impedence:

$$Z_o = R_C \| (1/h_{oe})$$

voltage gain:

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

$$v_i = I_b h_{ie} \text{ and } v_o = -I_c (R_C \| R_L)$$

$$\frac{1}{A_V} = \frac{I_b h_{ie}}{-I_c (R_C \| R_L)} \Rightarrow A_V = -\frac{h_{fe}(R_C \| R_L)}{h_{ie}}$$

Current gain:-

$$h_{fe} = \frac{I_c}{I_b}$$

$$\boxed{R_B = R_1 \| R_2}$$

$$I_c = \frac{h_{fe} I_s R_B}{R_B + Z_b}$$

$$I_b = \frac{I_s R_B}{R_B + Z_b}$$

$$\Rightarrow \frac{I_c}{I_s} = \frac{h_{fe} R_B}{R_B + Z_b}$$

$$I_L = \frac{I_c R_c}{R_c + R_L}$$

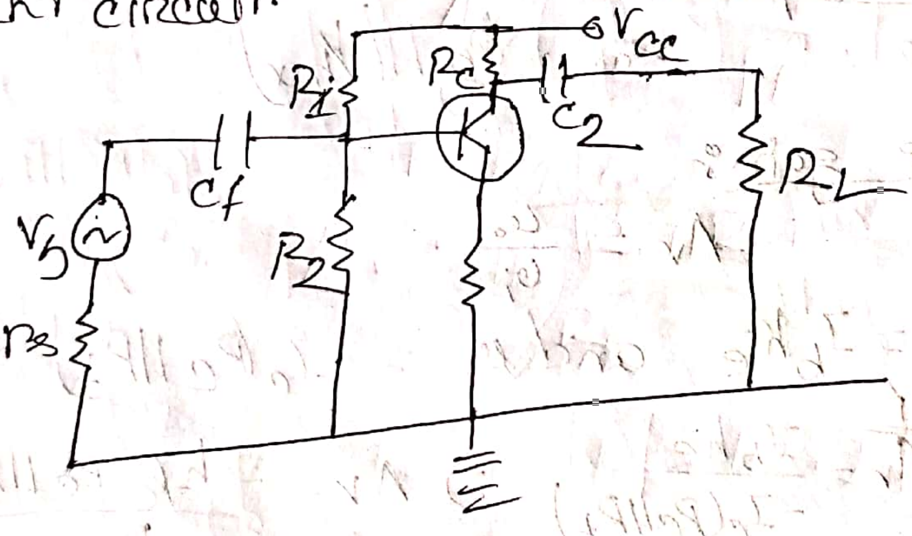
$$\Rightarrow \frac{I_L}{I_s} = \frac{h_{fe} R_B R_c}{(R_c+R_L)(R_B+r_b)}$$

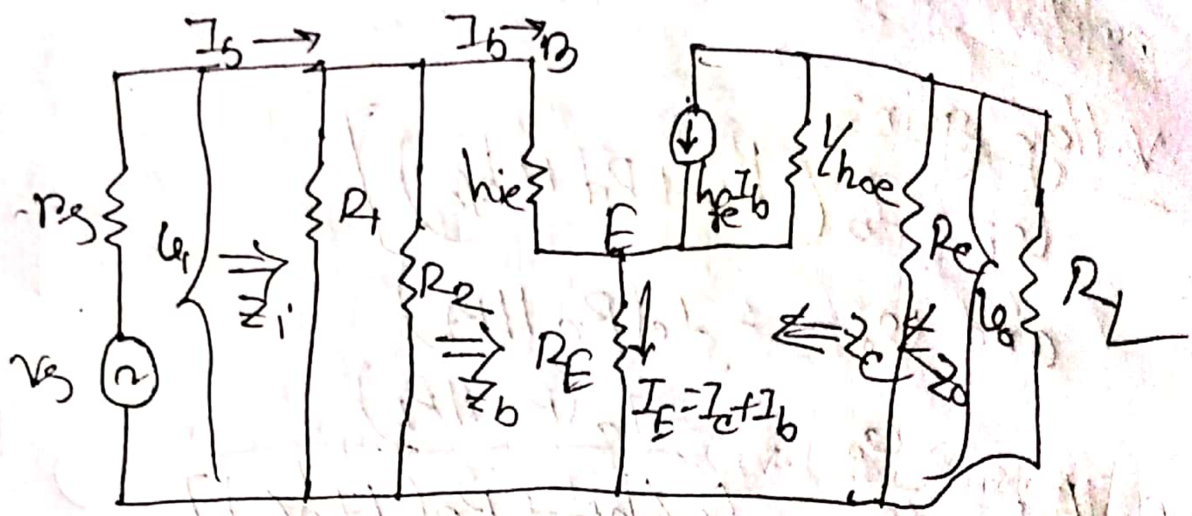
$$A_i = \frac{h_{fe} R_c R_B}{(R_c+R_L)(R_c+h_{ie})}$$

<u>power gain</u>

$$A_P = A_v A_i$$

Common-emitter configuration unbypassed equivalent circuit.





h-parameter equivalent circuit for CE circuit with unbypassed emitter circuit.

<u>input impedence:</u>

$$v_i = I_b h_{ie} + I_e R_E$$
$$= I_b h_{ie} + R_E (I_b + I_c)$$
$$= I_b h_{ie} + R_e (I_b + h_{fe} I_b)$$
$$= I_b (h_{ie} + R_e (1 + h_{fe}))$$
$$\Rightarrow \frac{v_i}{I_b} = h_{ie} + R_e (1 + h_{fe})$$
$$\Rightarrow Z_b = h_{ie} + R_e (1 + h_{fe})$$
$$\therefore Z_i = (R_1 \| R_2 \| Z_b)$$

Output impedance:

$$Z_o = R_e$$

Voltage gain:

$$v_i = I_b\left(h_{ie} + R_e(1+h_{fe})\right)$$

and $v_o = -I_c(R_c \parallel R_L)$

$$A_v = \frac{v_o}{v_i} = \frac{-I_c(R_c \parallel R_L)}{I_b\left(h_{ie} + R_e(1+h_{fe})\right)}$$

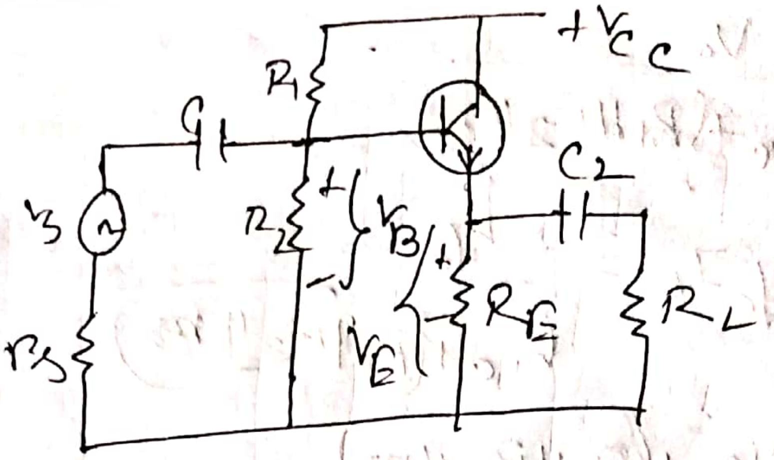
$$= \frac{-h_{fe}(R_c \parallel R_L)}{h_{ie} + R_e(1+h_{fe})}$$

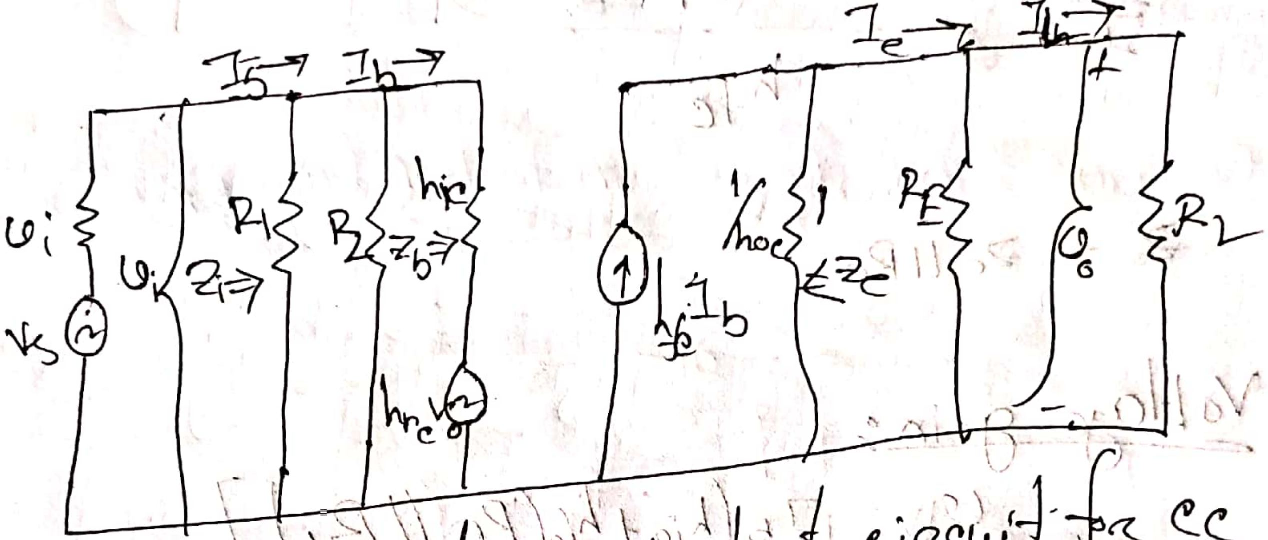
This reduces to, $A_v \simeq \frac{-(R_c \parallel R_L)}{r_e' + R_E}$

$$R_E \gg r_e'$$

$$A_v \simeq \frac{-(R_c \parallel R_L)}{R_e}$$

Common-collector circuit





h-parameter equivalent circuit for CC

input impedence:-

$v_i = I_b h_{ic} + h_{re} v_o$

$= I_b h_{ic} + I_e (R_E \| R_L)$

$= I_b h_{ic} + h_{fc} I_b (R_E \| R_L)$

$\Rightarrow v_i = I_b (h_{ic} + h_{fc}(R_E \| R_L))$

$\Rightarrow \frac{v_i}{I_b} = h_{ic} + h_{fe}(R_E \| R_L)$ $\therefore Z_b = h_{ic} + h_{fe}(R_E \| R_L)$

$Z_i = R_1 \| R_2 \| Z_b$

Output impedance:

$$I_b = \frac{V_o}{h_{ic} + (R_1 \| R_2 \| R_S)}$$

$$I_e = h_{fe} I_b = \frac{h_{fe} V_o}{h_{ic} + (R_1 \| R_2 \| R_S)}$$

$$\frac{V_o}{I_e} = \frac{h_{ic} + (R_1 \| R_2 \| R_S)}{h_{fc}}$$

$$Z_o = Z_e \| R_e$$

Voltage gain:

$$V_i = I_b\left[h_{ic} + h_{fc}(R_E \| R_L)\right]$$

$$V_o = I_e(R_E \| R_L)$$

$$A_V = \frac{V_o}{V_i} = \frac{I_e(R_E \| R_L)}{I_b\left[h_{ic} + h_{fc}(R_E \| R_L)\right]}$$

$$A_V = \frac{(R_E \| R_L)}{h_{ib} + (R_E \| R_L)}$$

$$A_V \cong 1$$

Common - base circuit analysis :-

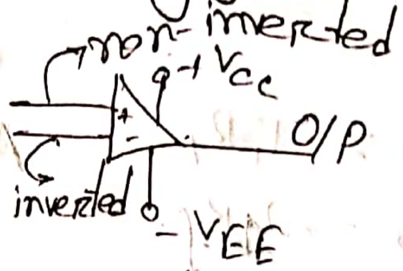
internal

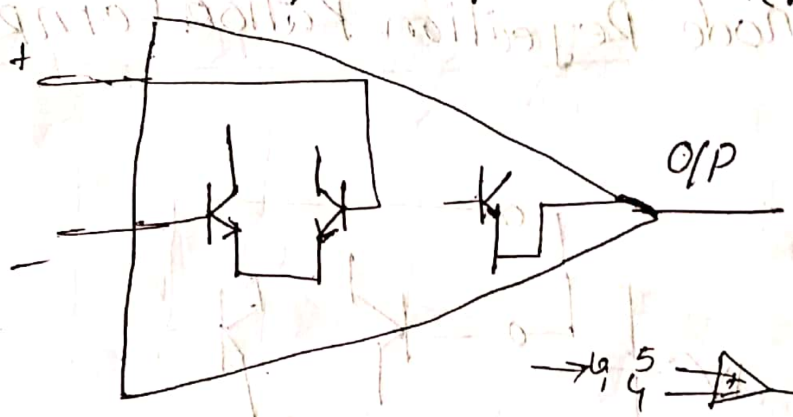
27-01-2020

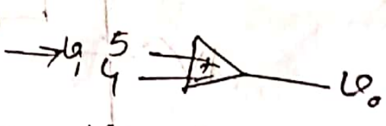
Introduction to operational- analysis :

operation Amplifier

- high gain
- 2 high i/p impedence terminal



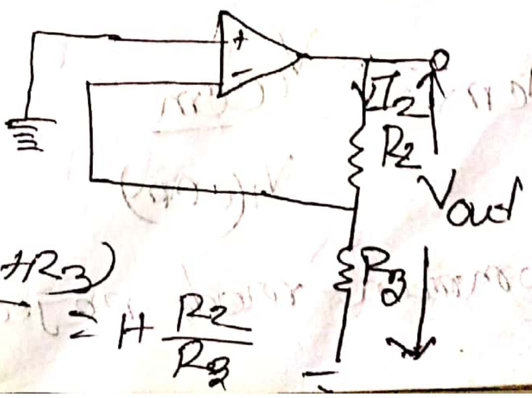




$v_i = 5 - 4 = 1$

$$\text{Voltage gain} = \frac{v_o}{v_i}$$

Non- inverting amplifier :-



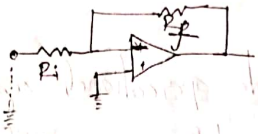
$V_{R_3} = I_2 R_2$

$V_o = I_2 (R_2 + R_3)$

$$A_V = \frac{v_o}{v_i} = \frac{I_2 (R_2 + R_3)}{I_2 R_3} = 1 + \frac{R_2}{R_3}$$

Scanned with CamScanner

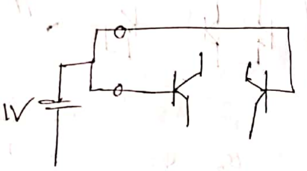
Inverting amplifier: chapter-1



$v_i = I_1 R_1$ $\quad A_V = \frac{v_1}{v_2} = -\frac{R_f}{R_1}$

$v_o = -I_1 R_f$

Common mode Rejection Ratio (CMRR)



$v_{in} = v_{1in} - v_{2in}$

$= 1V - 1V$

$= 0$

$A_{cm} = \frac{V_{occm}}{V_{i(cm)}}$ $\quad CMRR = \frac{m}{A_{cm}}$

$= 20\log\frac{m}{A_{cm}}$ dB

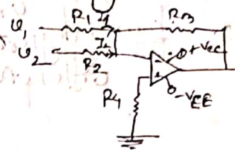
common-mode rejection ration

Summing Amplifier:

→ i) inverting

→ ii) non-inverting

inverting



$v_o = A_V(v_1 + v_2)$

$I_1 = \frac{V_1}{R_1}$

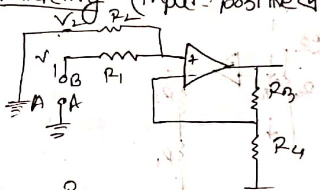
$I_2 = \frac{V}{R_2}$

$v_o = -(I_1 + I_2)R_3$

$[\text{if}, R_1 = R_2 = R] = -\left(\frac{v_1}{R_1} + \frac{V_2}{R_2}\right)R_3$

$V_o = -\frac{R_3}{R_1}(V_1 + V_2)$

non-inverting (input positive (+) from non-inverting)



$A_\alpha = 1 + \frac{R_3}{R_4}, V_2 = 0$

$V_{i1} = \frac{R_1}{R_1 + R_2} V_1 = \frac{V_1}{2}$ $\quad [R_1 = R_2], V_2 = 0$

$v_{i2} = \frac{V_2}{2}, \quad v_1 = 0$

$v_{in} = v_{i1} + v_{i2}$

$= \frac{v_1 + v_2}{2}$

$v_o = A_v \cdot v_{in}$

$= \left(\frac{R_3+R_4}{R_4}\right) \times \left(\frac{v_1+v_2}{2}\right)$

$v_o = v_1+v_2$

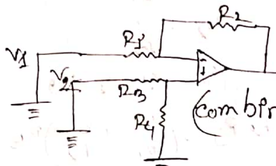
$= A_v(v_1+v_2)$

chapter-1,2

h.w

$\boxed{\text{operational amplifier and circuit, integrated circuit, differentiating circuit}}$

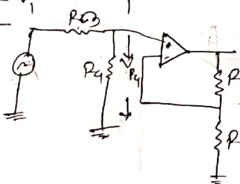
Difference Amplifier:



Combinating of inverting & non-inverting

$v_o = v_2 - v_1$

$v_{o1} = -\frac{R_2}{R_1} v_1 = -v_1$



$V_{R_4} = \frac{R_4}{R_3+R_4} v_2$

$\therefore V_{o2} = \frac{R_1+R_2}{R_1} V_{R_4}$

$V_{o2} = \frac{R_1+R_2}{R_1} \times \frac{R_4}{R_3+R_4} \times V_2$

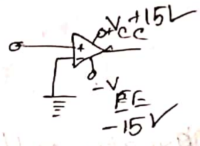
$= v_2$ [if $R_1 = R_2$, $R_3 = R_4$]

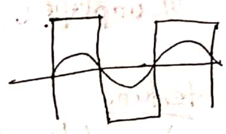
$v_o = v_{o2} + v_{o1}$

$= v_2 - v_1$

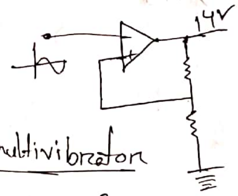
Steco-rate:

Zero Crossing Detector: chapter-2

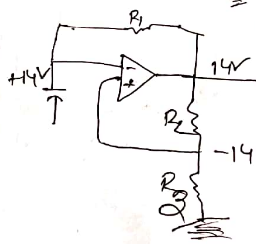


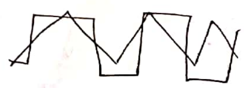


inverting speed trigger:



astable-multivibrator





Uni Juinction Transistor (UJT)

use

i) osscilloscope make
ii). amplifier

feature

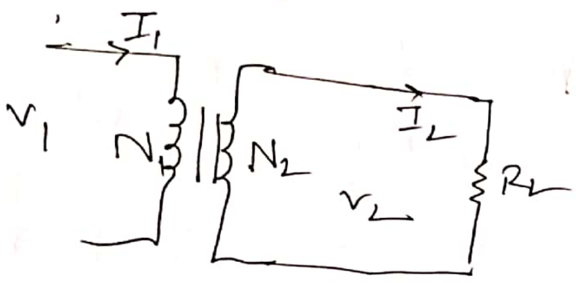
i) A stable triggering voltage

H.W. SCR ~~Disc, Tisc~~
Triacs
Driacs

17-02.20

dc power = ac power + loss

Transformer couple transformer:-



$R_L = \frac{V_2}{I_2}$

$R_L' = \frac{V_1}{I_1}$

Basics transformer theory.

$\frac{V_1}{V_2} = \frac{I_2}{I_1}$, $\frac{V_1}{V_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1}$

$P_1 = P_2 \Rightarrow V_1 I_1 = V_2 I_2$

$\Rightarrow I_1 = \frac{N_2}{N_1} I_2$

$\Rightarrow \frac{1}{I_1} = \frac{N_1}{N_2} \frac{1}{I_2}$

$R_L' = \frac{V_1}{I_1}$

$= \left(\frac{N_1}{N_2}\right)^2 R_L$

$= \frac{R_L}{n^2}$ $\boxed{n = \frac{N_2}{N_1}}$

Efficiency of a class A—:

$\eta = \frac{\text{ac O/P power}}{\text{dc input power}} \times 100\%$

$P_i = V_{CE} \times I_{avg}$

$= V_{CE} \times I_{CQ}$

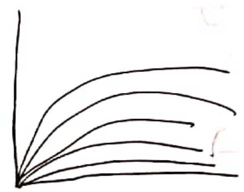
$\leq 0.5 \times V_{CC} \times I_{CQ}$

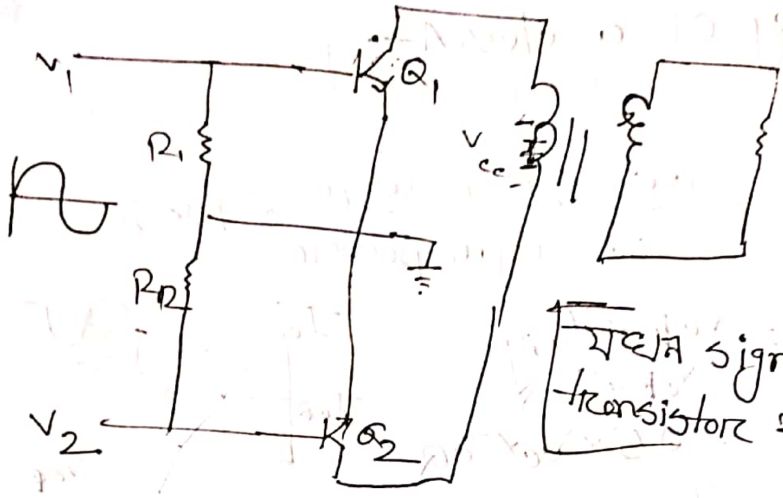
$P_o = V_{rms} \times I_{rms}$

$= \frac{V_P}{\sqrt{2}} \times \frac{I_P}{\sqrt{2}}$

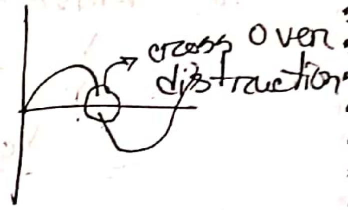
$= \frac{V_{CC} I_{CQ}}{2}$; $\boxed{25-50\% \text{ maximum efficiency}}$

Class B power amplifier





যখন signal পাবে তখন transistor কাজ করবে।



cross over distruction:

splitter (use transformer)