Expression for g_m

$$g_m = \left.\frac{dI_D}{dV_{gs}}\right|_{Q\text{-pt}}.$$

But $I_D = I_{DSS}\left[1 - \frac{V_{GS}}{V_P}\right]^2$

$$g_m = 2I_{DSS}\left[1 - \frac{V_{GS}}{V_P}\right]\left[\frac{-1}{V_P}\right]$$

$\frac{V_{GS}}{V_P}$ is +ve for both n-channel & p-

To get the value for g_m.

$$g_m = \frac{2I_{DSS}}{|V_P|}\left[1 - \frac{V_{GS}}{V_P}\right]$$

When $V_{GS} = 0$

$$g_{m0} = \frac{2I_{DSS}}{|V_P|}$$

For, $r_d \geq 10 R_D$

$r_d \parallel R_D = 0.909$

$r_d \parallel R_D \simeq$

$Z_0 \simeq R_D$

$\therefore$

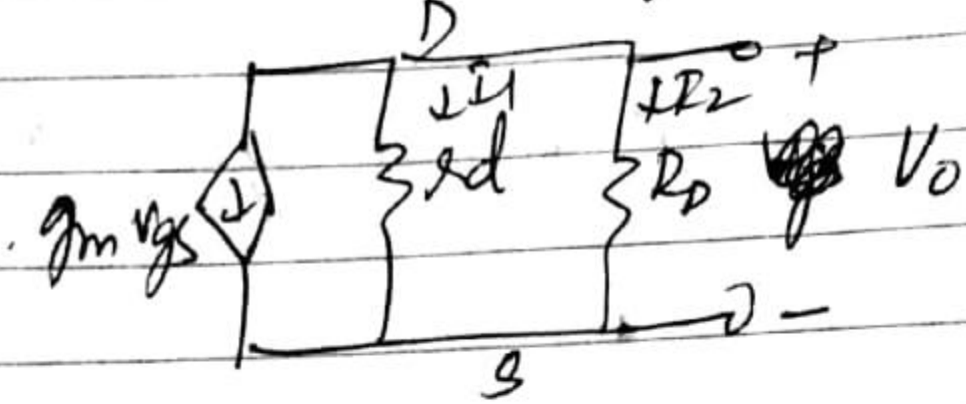
$\boxed{A_V \simeq -g}$

$$\boxed{Z_o = r_d \parallel R_D}$$

Voltage gain :-

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

$$V_i = V_{gs}$$

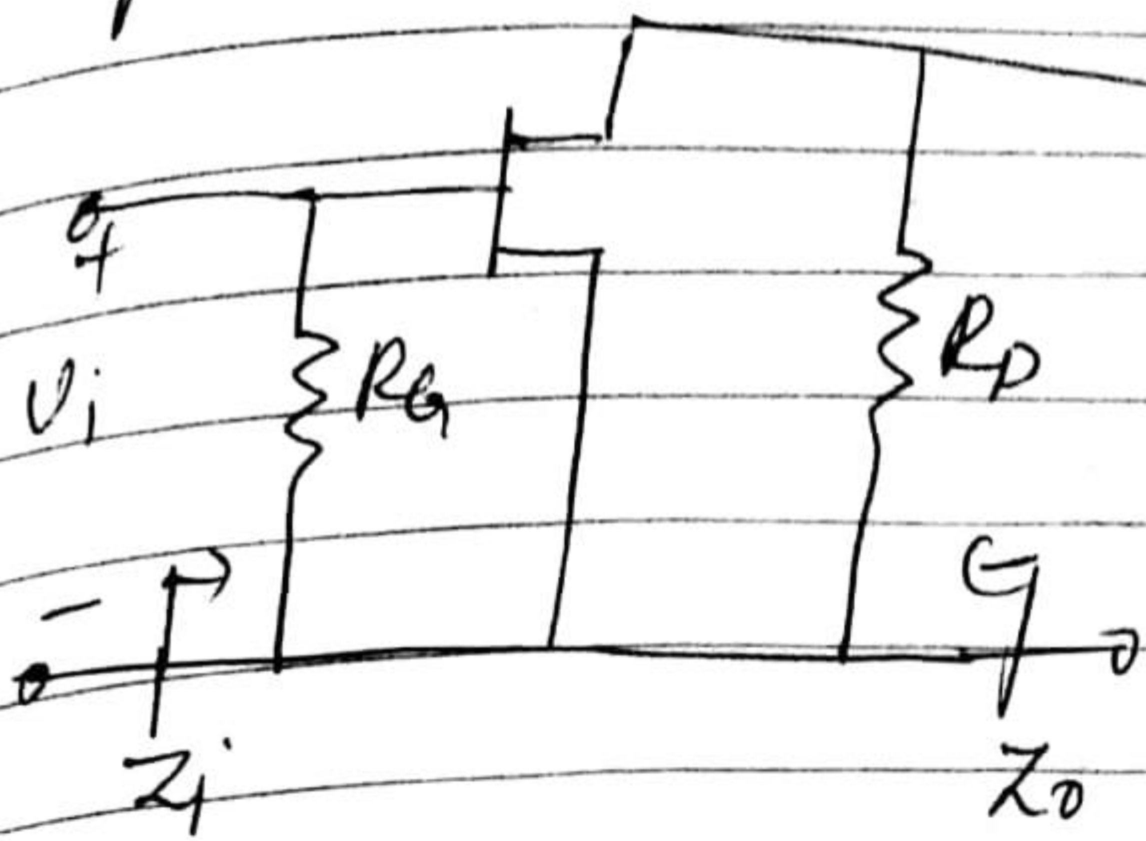


Applying KCL at the node

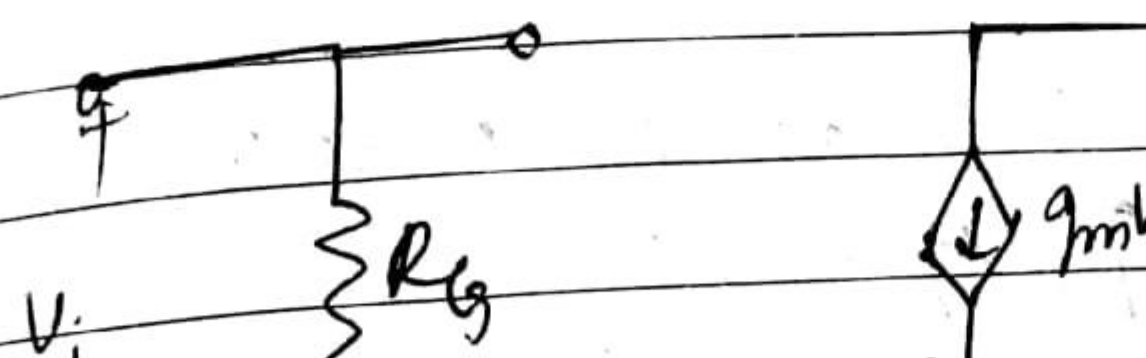
$$g_m V_{gs} + I_1 + I_2 = 0$$

$$I_1 = \frac{V_o}{r_d} \qquad I_2 =$$

AC Eq. Ckt is as shown



Replace the JFET by its
Ckt. The resulting Ckt is sho



x_f' is identically equal to the e
signal x_i. If the external source
terminal 2 is connected to termin
the amplifier will continue to give

$x_f' = x_i$ means the instantaneous
exactly equal at all times. x_f' &
feedback is the.

loop gain $= -A\beta$

$-A\beta = 1 +$

$-A\beta =$

$\therefore -A\beta =$

$|-A\beta| = |A\beta| = 1$

$\theta = \angle -A\beta =$

Conditions for Barkhausen

An oscillator is a ckt designed to
with no i/p signal. It requires on
An oscillator is basically an amp
feedback.

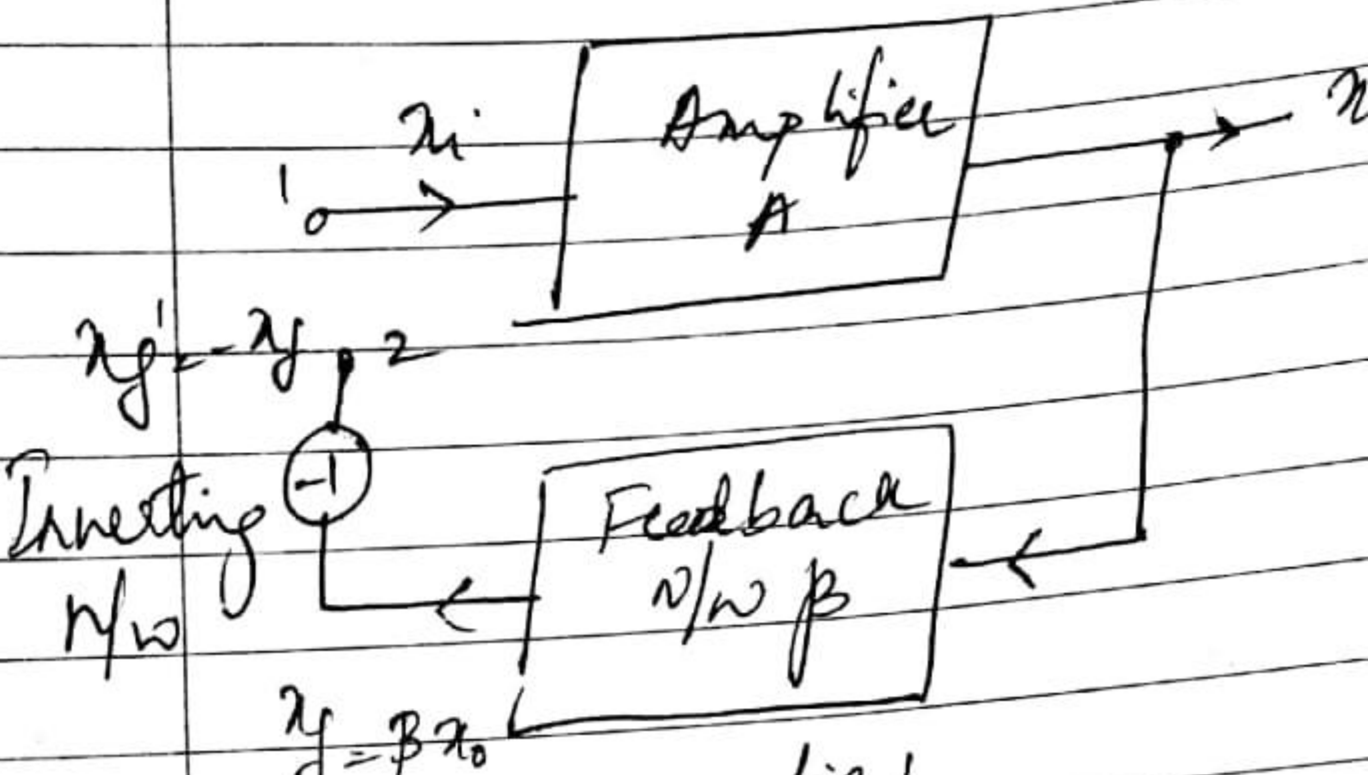


fig.1

fig.1 shows an amplifier a feed
inverting ~~amplifier~~ n/w not yet c
Closed loop.

The amplifier provides an o/p signal
signal x_i applied directly to the

Wein Bridge oscillator

is an RC oscillator & is use
in the audio frequency range.
It consists of an op-amp non-in
the forward path & a lead-lag

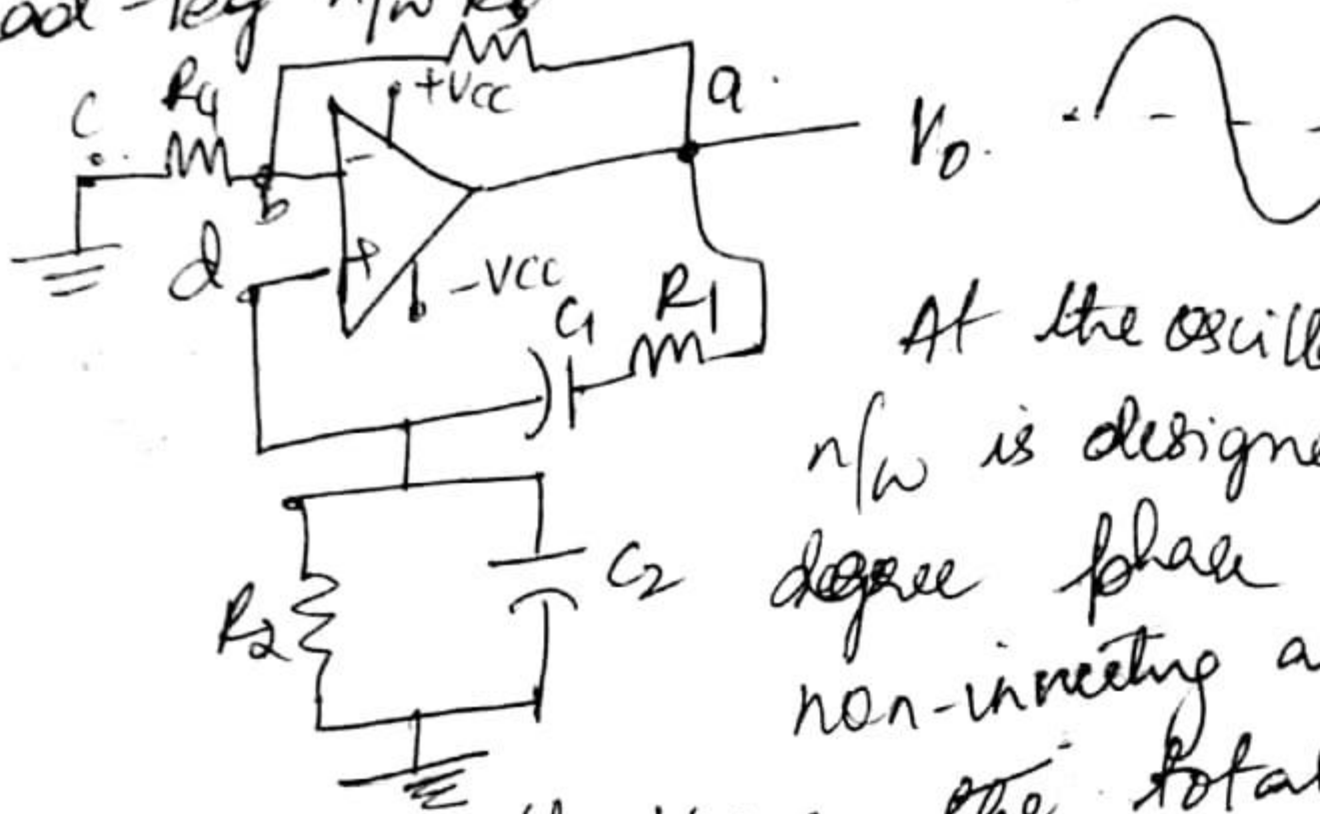
path.

Series R_1C_1 n/w → lead n/w

parallel R_2C_2 n/w → lag n/w.

The f/b resistors R_3 & R_4 of op-

lead-lag n/w forms a bridge as



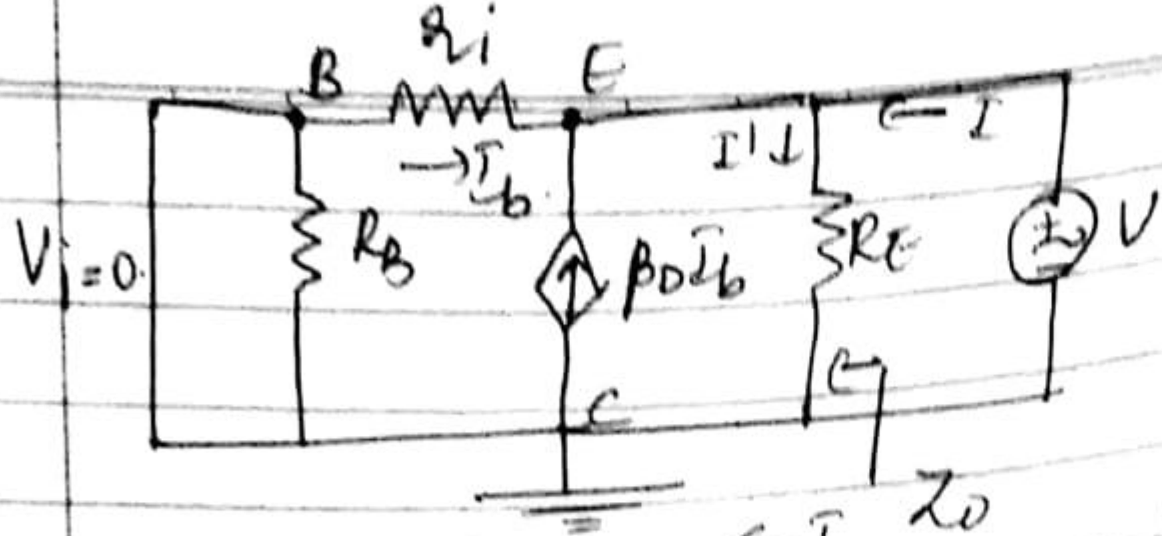
At the oscill

n/w is designe

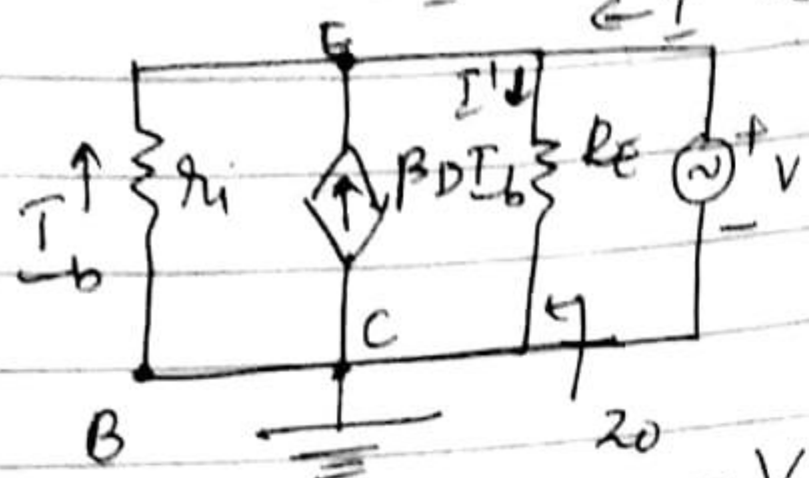
degree phase

non-inverting a

shift. Hence the total



Applyn



$I_b + \beta_D$

$I_b = \frac{-V}{r_i}$

$\frac{-V}{r_i} + \beta_D\left(\frac{V}{r_1}\right)$

$V\left[\frac{1}{r_1} + \frac{\beta_D}{r_i} + \frac{1}{R_E}\right.$

$\frac{V}{I} = \left[\frac{1}{1/r_i + \frac{\beta}{r}}\right.$

$\frac{V}{I} = r_i \| \beta_D |$

$$\frac{I_b}{I_i} = \frac{R_B}{R_B + r_b}$$

$$\boxed{A_i = \beta_D \frac{R_B}{R_B + r_B}}$$

voltage gain :- (A_V)

$$V_O = I_e R_E$$
$$= (1+\beta_D) I_b R_E$$

$$V_i = I_b [Z_i]$$
$$= I_b [r_i + (1+\beta_D) R$$

Now $A_V = \frac{V_O}{V_i} = \frac{(1+\beta_D)}{\cancel{I_b}[r_i +}$

At i/p impedance (Z_i)
Applying KVL to the i/p ckt

$$V_i = I_b r_i + I_e R_E$$

w.k.t $I_e = (1+\beta_D) I_b$

$$V_i = I_b r_i + (1+\beta_D) R_E I$$

$$Z_b = \frac{V_i}{I_b} = r_i + (1+\beta_D$$

β_D is very high, then

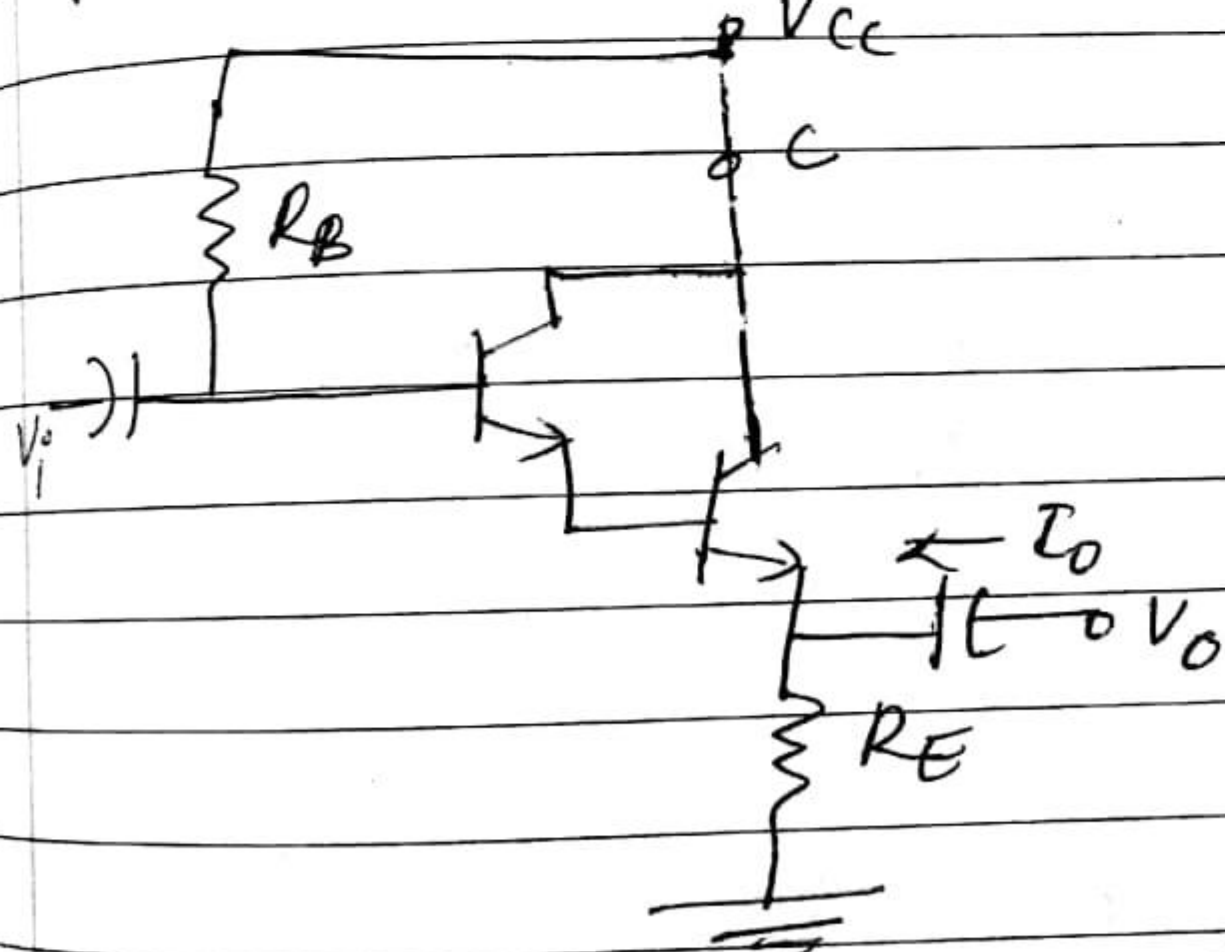
$$Z_i = \frac{V_i}{I_i} = R_B \| Z_b$$

Current gain :

$$A_I = \frac{I_o}{I_i} = \frac{I_o}{I_b} \times \frac{I_b}{I_i}$$

Darlington emitter follower c

The ac input vlg V_i is coup
darlington transistor the o
coupling capacitor C_1. The ac
at the emitter follower thr
capacitor C_2



The ac equivalent ckt of d

The o/p impedance will be eq
impedance of the last stage

$$Z_i = Z_{i1} \quad \& \quad Z_0 = Z_{03}.$$

Since the o/p of one stage is con
the other stage.

$$V_{i2} = V_{01} \quad \& \quad V_{i3} = V_{02}.$$

The overall vlg gain,

$$A_{VT} = \frac{V_0}{V_i}$$

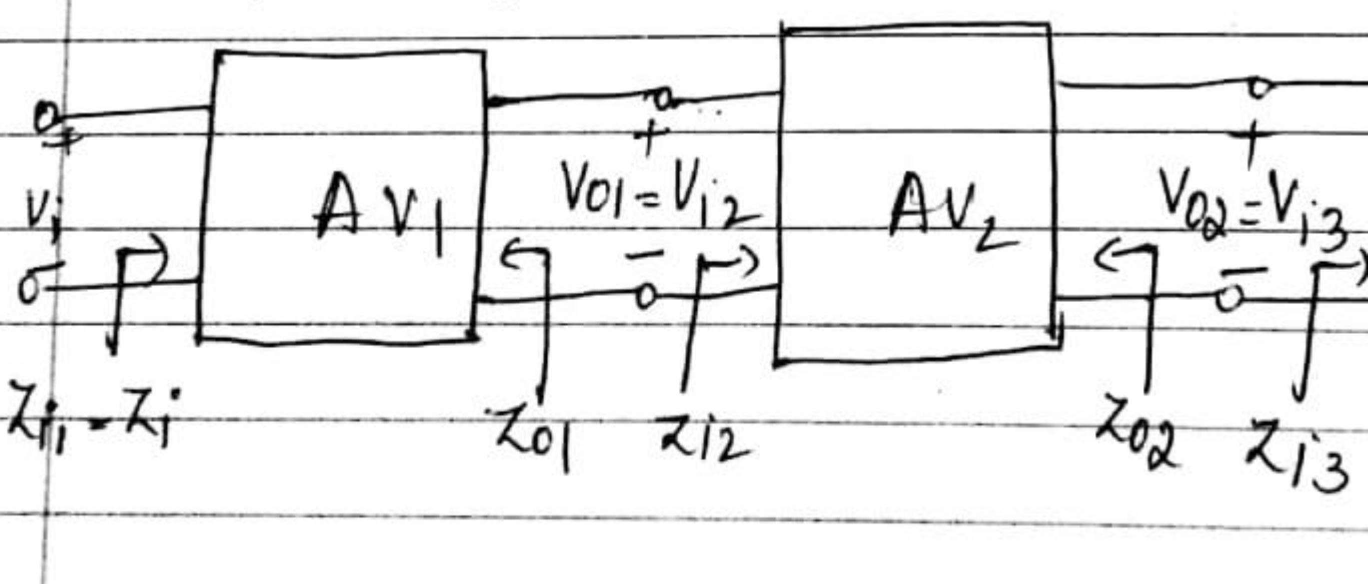
$$= \frac{V_0}{V_{i3}} \times \frac{V_{i3}}{V_{i2}}$$

$$A_{VT} = A_{V3} \times A_{V2} \times A$$

The Cascade of CE & CB stages o
amplifiers.

Cascaded systems :-

when the amplification from a
amplifier is not sufficient for a
when the input or o/p impedance
magnitude for the intended applicat
amplifiers are connected in Cascade
given stage is connected to the
stage. Such an arrangement is kno
multistage Amplifiers.



Relation B/w I_D & g_m

$$I_D = I_{DSS}\left[1-\right.$$

$$\frac{I_D}{I_{DSS}} = \left[1-\frac{V_G}{V_P}\right.$$

$$\left[1-\frac{V_{GS}}{V_P}\right] =$$

w.k.T $g_m = g_m$

$$\frac{g_m}{g_{mo}}$$