P.No 1:-

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Paper : Electronic Circuit Design

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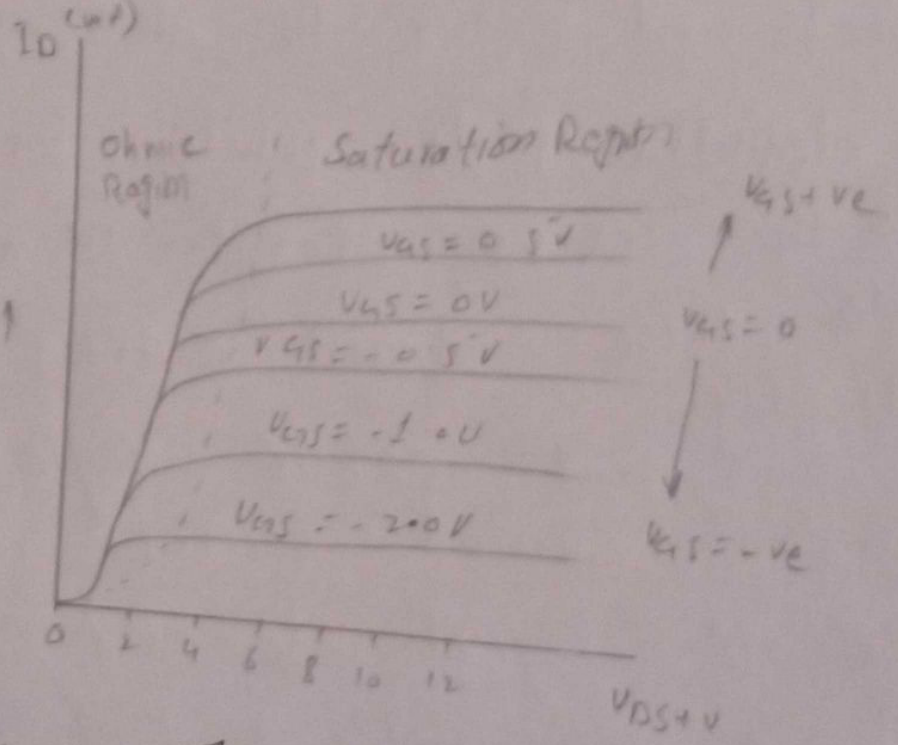
Dep : BE(E)

Marks:- 30

P.No 2:-

Vo 1

a):- Explain the drain Characteristic Curve of D-MOSFET given below.



Solution:-

Explaination of Charactristics Curve of D-MOSFET:-

Typical drain characteristics for various levels of gates-source voltage of an N-channel MOSFET are shown is the fig. The upper curve are for positive V_{GS} and the lower curve are for negative V_{GS}. The bottom drain curve is for $V_{GS} = V_{GS(OFF)}$. For a specified drain-source voltage V_{DS}, $V_{GS(OFF)}$ is the gate-source voltage at which drain current reduce

to a certain specified negligibly small value as show in fig.

This voltage corresponds to the pinch off voltage V_P of JFET. For V_{GS} between $V_{GS(OFF)}$ and zero, the device operates in depletion-mode while for V_{GS} exceeding zero the device operates in enhancement mode. these drain curves again display an ohmic region, a constant current source region and cut-off region. MOSFET has two major application a constant current source and a voltage variable source.

Q NO 1:-

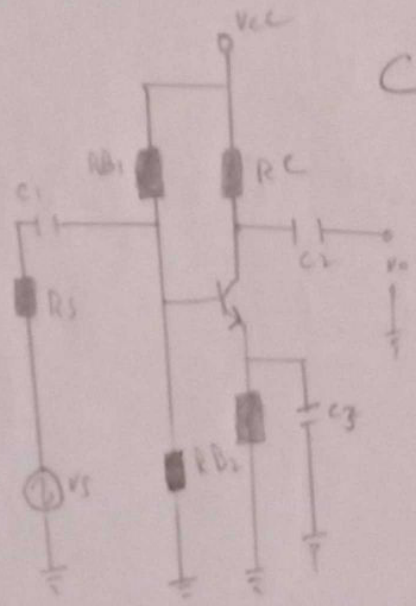
b):- Sketch the hybrid model and write equation for the transistor in common emitter configuration.

Answer:- The hybrid model is a popular circuit model used for analysing the small signal behavior of bipolar junction

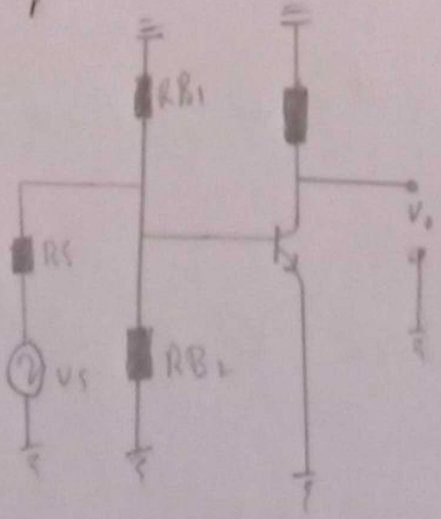
nel field effect transistor. Sometime it is also called Giacoletto model beacause it was introduced by L.J. Giacoletto in 1969.

Sketch is below:-

Common Emitter



Equivalent Circuit



∴ The hybrid model is suitable for small signals at mid band and describes the action of the transistor

D.N.O.S:

Two equations can be derived for the diagram, one for input voltage V_{be} and one for the output I_c.

$$V_{DC} = h_{ie} i_b + h_{re} v_{ce}$$

$$i_c = h_{fe} i_b + h_{OC} v_{CP}$$

if in is held constant ($i_b = 0$) then hre and hoe can be solved:

$$h_{re} = v_{be} / v_{ce} \,|\, i_b = 0$$

$$h_{oe} = i_c / v_{cc} \,|\, i_b = 0$$

Also if v_{ce} is held constant ($v_{ce} = 0$) that hie and hfe can be solved.

$$h_{ie} = v_{bc} / i_b \,|\, v_{ce} = 0$$

$$h_{fe} = i_c / i_b \,|\, v_{ce} = 0$$

No 2:- A certain operational amplifier has a common mode gain of 0.6 and an open loop differential voltage gain of 400,000. Evaluate the CMRR & express it in decibels.

S&T:- Given.

differential voltage gain = 400,000

common mode gain = 0.6

Required:

CMRR = ?

Formula

$$\Rightarrow CMRR = \frac{\text{voltage gain}}{\text{common mode gain}}$$

$$CMRR = \frac{400000}{0.6}$$

$$CMRR = 666666.66$$

Now in decibels

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by formula

$$CMRR = 20 \log (6666666 \cdot 6)$$

$$\boxed{CMRR = 116.47 \text{ decibels}}$$

Q No3

a):- Explain the concept behind negative feed back in operational amplifiers.

Answer:-

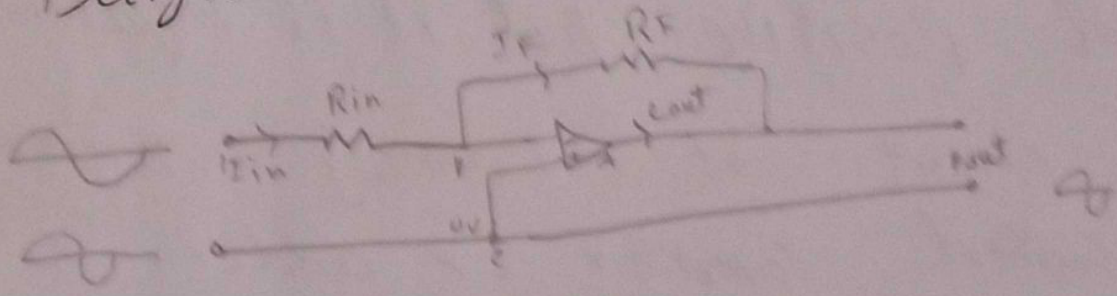
Negative feed back:-

Negative feedback is the process of feeding back a fraction of the output signal back to the input but to make the feed back negative, we must feed it back to the negative or inverting input terminal of the op-amp using an external feed back resistor called Rf. This feed back connection between the

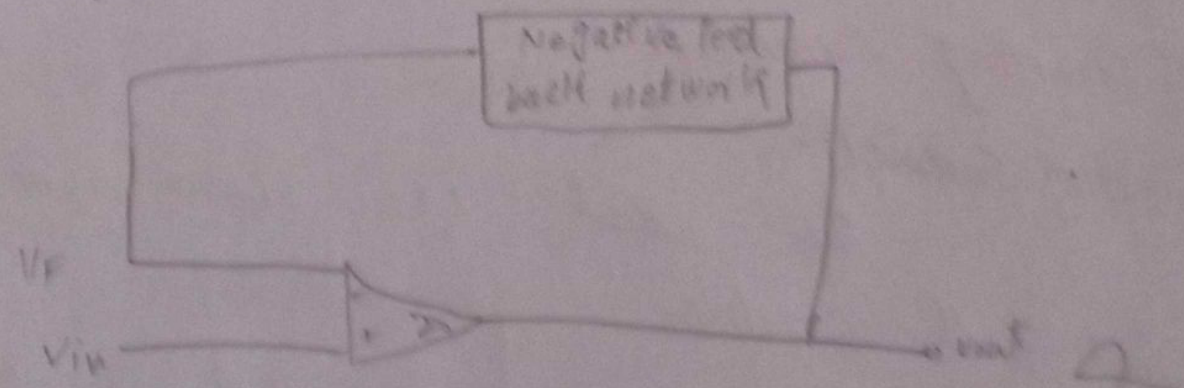
output and the inverting input terminal forces the differential input voltage towards zero

Inverting input effectively moves the feed back signal 180 out of phase with the input signal

Daigram:-



The inverting operational amplifier configuration is one of the simplest and most commonly use operational amplifier.



Q No 3

b):- State the following statement as true or False and also give the reason for your answer: " The out put of a summing amplifier is positive:-

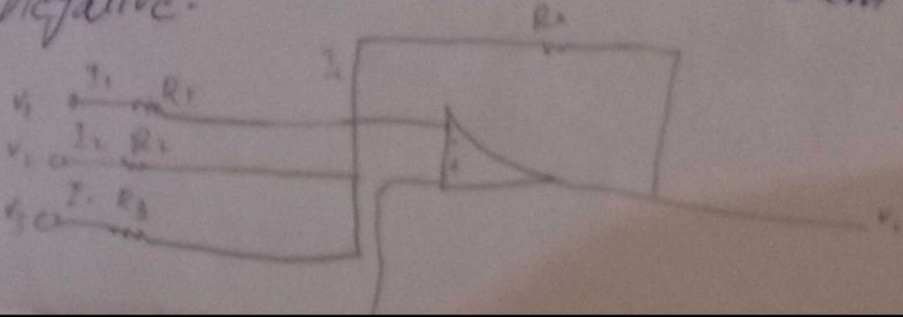
Ans:- The Statement is False because the output of summing amplifier is not positive but it is negative. The circuit of summing amplifier is called summer or adder.

Summing amplifier:-

There are two types of summing amplifier one is inverting summer and the other one is Non-inverting summer.

1) Inverting Summer:-

The output is linear sum of input with negative.



apply KCL

$$I_1 + I_2 + I_3 = I_f$$

$$\frac{v_1 - v_1}{R} + \frac{v_2 - v_y}{R_2} + \frac{v_3 - v_y}{R_3} = \frac{v_y - v_o}{R_f}$$

by virtual ground concept

$$v_y = v_2 = 0$$

we get

$$\frac{v_1}{R_1} + \frac{v_2}{R_2} + \frac{v_3}{R_3} = \frac{v_o}{R_f}$$

So output voltage

$$v_o = -R_f \left[\frac{v_1}{R_1} + \frac{v_2}{R_2} + \frac{v_3}{R_3} \right]$$

i) if $R_1 = R_2 = R_3 = R_f = R$

$$v_o = -R_f \left[\frac{v_1}{R_1} + \frac{v_2}{R_2} + \frac{v_3}{R_3} \right]$$

$$v_o = -(v_1 + v_2 + v_3)$$

ii) If $R_2 = R_1 = R_3 = R$ & $R_f = R/n$

$$v_o = -R_f \left[\frac{v_1}{R_1} + \frac{v_2}{R_2} + \frac{v_3}{R_3} \right]$$

$$v_o = -\frac{R}{n} \left[\frac{v_1 + v_2 + v_3}{R} \right]$$

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$$V_0 = -\left(\frac{V_1 + V_2 + V_3}{n}\right)$$

Since $n = 3$ for 3 inputs

iii) If $R_1 \neq R_2 \neq R_3$

~~$R_f = R_1 = R_2$~~

$$R_f/R_1 = A$$

$$R_f/R_2 = B$$

$$R_f/R_3 = C$$

$$V_0 = -R_f\left[\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right]$$

$$V_0 = -[AV_1 + BV_2 + CV_3]$$