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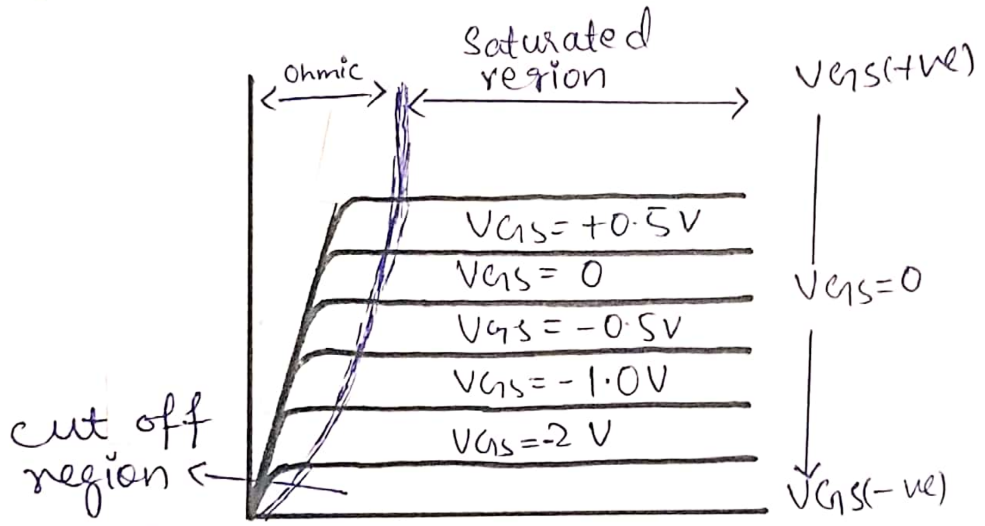
Subject : Electronic Circuit Design

Mid Assignment

Submitted to Engr. Mujtaba Ihsan

Q#01 (a)
Explain the drain characteristic curve of D-MOSFET given below.



In this curve of D-MOSFET have three region

(i) **Cut off region**: cut-off region is a region in which the MOSFET will be OFF as there will be no current flow through it. In this region, MOSFET behaves like an open switch and is thus used when they are required to function as electronic switch.

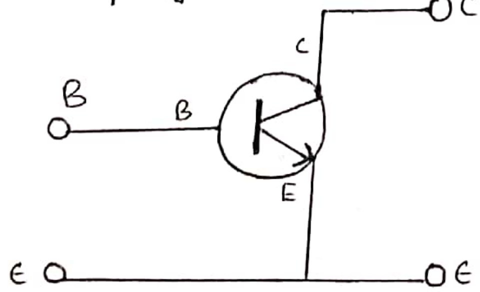
(ii) **Ohmic or Linear Region**:
Ohmic is a region where in the current IDS increases with an increase in the value of VDS. When MOSFET are made to operate in this region, they can be used as amplifiers.

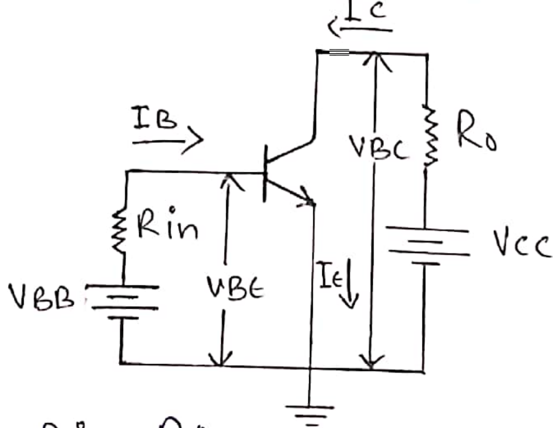
(iii) **Saturated region**: In Saturated region, the MOSFET have their I_{DS} constant inspite of an increase in V_{DS} and occurs one V_{DS} exceeds the value of pinch-off voltage V_p. Under this condition the device will act like a closed switch through which a saturated value of I_{DS} flows. This region is chosen whenever MOSFETs are required to perform switching operation.

→ A D-MOSFET can conduct current even when $V_{GS} = 0$.

Q#01 (b)

Sketch the hybrid model and write equations for the transistor in common emitter configuration.





$$\left.\begin{array}{l} R_{in} = R_{in} \\ V_{in} = V_{BE} \\ I_{in} = I_B \end{array}\right\} R_{in} = \frac{V_{BE}}{I_B}$$

• Current gain

$$\beta = \frac{I_C}{I_B}$$

$$\left.\begin{array}{l} R_o = R_o \\ V_o = V_{CE} \\ I_o = I_C \end{array}\right\} R_o = \frac{V_{CE}}{I_C}$$

Q#02

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 and express it in decibels.

Given

A_{OL} = open loop differential voltage gain = 400,000

A_{cm} = Common mode gain = 0.6

Solution:

$$CMRR = A_{OL}/A_{cm}$$

$$CMRR = 400{,}000/0.6$$

$$CMRR = 666{,}666.66$$

CMRR in decibels:

$$CMRR = 20\log(A_{OL}/A_{cm})$$

$$= 20\log(666{,}666.66)$$

$$= 116.48\ dB$$

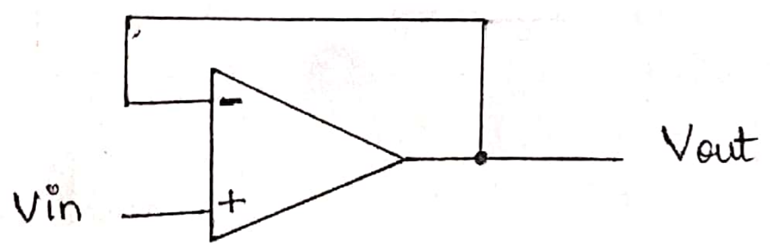
Q#03 (a)

Explain the concept behind negative feedback in operational amplifiers.

Ans: Taking the operational amplifiers output voltage and coupling it to the inverting input is a technique known as negative feedback.

When the output of an op-amp is directly connected to its inverting (-) input a voltage follower will be created. Whatever signal voltage is impressed upon the noninverting (+) input will be seen on the output.

An op-amp with negative feedback will try to drive its output voltage to whatever level necessary so that the differential voltage between the two inputs is practically zero. The higher the op-amp differential gain, the closer that differential



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Q#03 (b)

State the following statement as True or False and also give the reason for answer.

"The output of a summing amplifier is Positive."

Ans: "False"

Reason: This statement is false, because that an inverting summing amplifier produces the negative sum of its input voltages and that the non inverting Summing amplifier configuration will produce the positive sum of its input voltages.