Department of Electrical Engineering
Assignment
Date: 14/04/2020

Course Details

Course Title: Electronic Circuit Design **Module:** 04
Instructor: **Total Marks:** 30

Student Details

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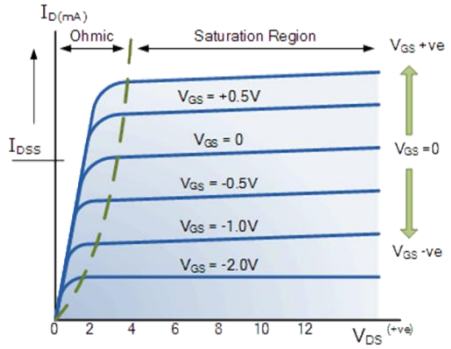
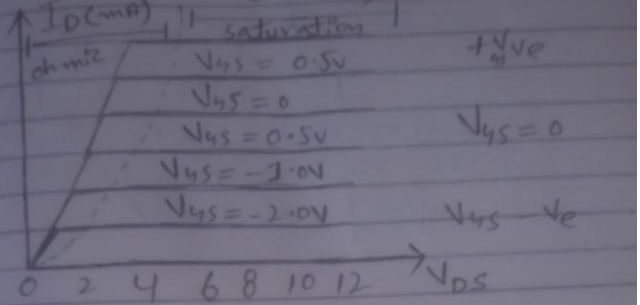
Q1.	(a)	**Explain** the drain characteristic curve of D-MOSFET given below. 	Marks 07 CLO 1
	(b)	**Sketch** the hybrid model and write equations for the transistor in common emitter configuration.	Marks 06 CLO 1
Q2.		A certain operational amplifier has a common mode gain of 0.6 and an open loop differential voltage gain of 400,000. **Evaluate** the CMRR & express it in decibels.	Marks 05 CLO 2
Q3.	(a)	**Explain** the concept behind negative feedback in operational amplifiers.	Marks 06 CLO 2
	(b)	**State** the following statement as **True** or **False** and also give the reason for your answer: "The output of a summing amplifier is positive"	Marks 06 CLO 2

(1)

Q1 (a)



The give VI - characteristic give the information about the voltage and current. The voltage that is V_{DS} and the current that is I_D. Actually V_{DS} is voltage of Drain to source and I_D is current of drain. And this curve actually gives the relation between V_{DS} and I_D. Drain and source have a channel between it. This channel act as a good conductor. This channel width and drain current depends on gate voltage if gate voltage is

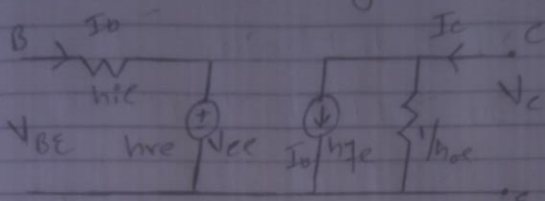
negative the decrease in width of channel and drain's current occure while if gate voltage is (increase) +ive then width and drain current is going increase.

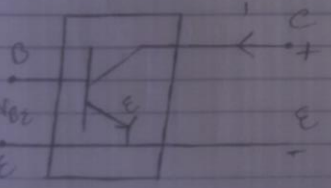
(3)

Q1 (b)

Ans:

Common emitter hybrid Model:

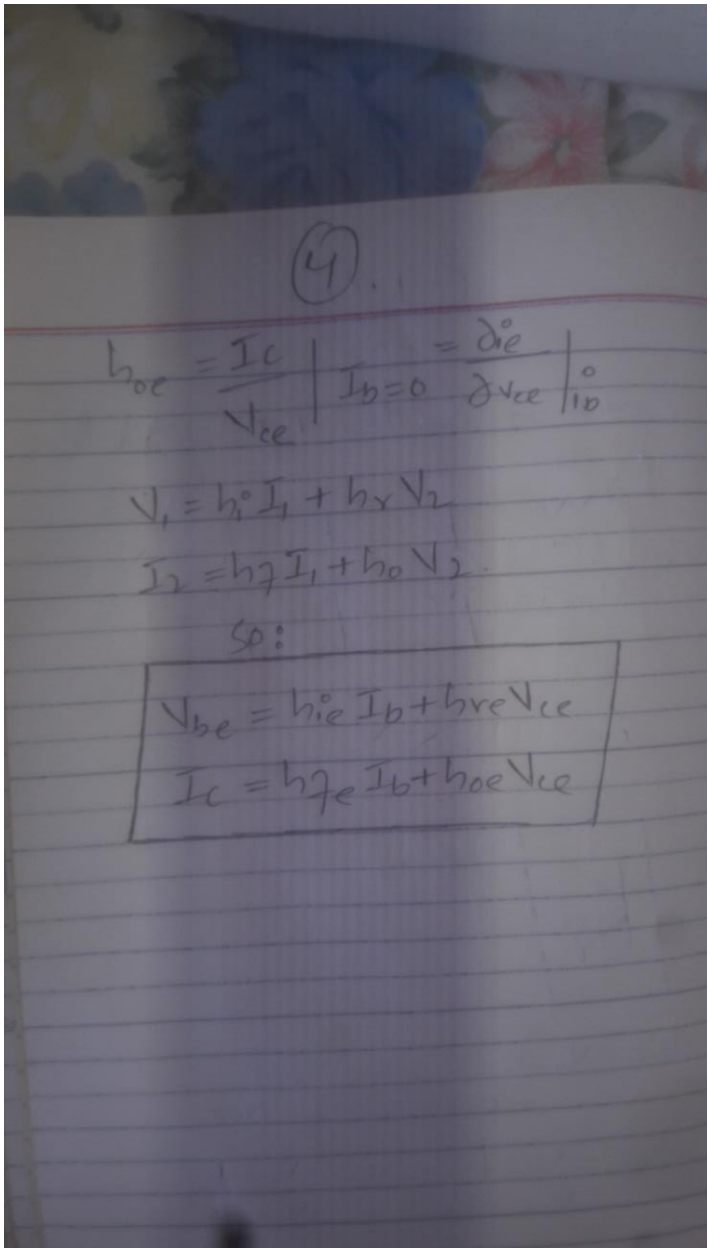




$$h_{ie} = V_{be}\Big|_{V_{ce}=0} = \frac{\partial V_{be}}{\partial i_b}\Big|_{V_{ce}}$$

$$h_{re} = \frac{V_{be}}{V_{ce}}\Big|_{I_b=0} = \frac{\partial V_{be}}{\partial V_{ce}}\Big|_{i_b}$$

$$h_{fe} = \frac{I_c}{I_b}\Big|_{V_{ce}=0} = \frac{\partial i_c}{\partial i_b}\Big|_{V_{ce}}$$



(4).

$$h_{oe} = \frac{I_c}{V_{ce}}\bigg|_{I_b=0} = \frac{\partial i_e}{\partial v_{ce}}\bigg|_{i_b}^{0}$$

$$V_1 = h_i^{\circ} I_1 + h_r V_2$$

$$I_2 = h_f I_1 + h_o V_2$$

So:

$$\boxed{\begin{aligned} V_{be} &= h_{ie}^{\circ} I_b + h_{re} V_{ce} \\ I_c &= h_{fe} I_b + h_{oe} V_{ce} \end{aligned}}$$

(5)

Q2 Ans:

Given:

Common mode gain

$A_{cm} = 0.6$

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

Find:

CMRR = ?

Solution:

As we know:

$$CMRR = \frac{A_{OL}}{A_{CM}}$$

putting values:

$$= 400,000 / 0.6$$

$$\boxed{CMRR = 666,666.6}$$

(b)

Now:

CRRM in decibels:

$CRRM = 20 \log (A_{OL}/A_{CM}) \rightarrow (i)$

As $(A_{OL}/A_{CM}) = 666,666.6$

putting in (i).

$CRRM = 20 \log (666,666.6)$

$\boxed{CRRM = 116.47 \text{ dB}}$

Q3 (a) Ans:

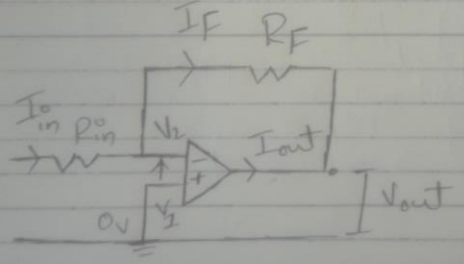
Negative Feedback Operational Amplifier:

If we connect the output of an op-amp to its inverting input and apply a voltage signal to non-inverting of op-amp closely follows that input voltage. I've neglected to draw in the power supply +V/-V wires and ground symbol for simplicity.

As V_{in} increase, V_{out} will increase in accordance with the differential gain. However as V_{out} increase that output voltage is feed back to the inverting input, thereby acting to decrease the voltage differential between input.

which act to bring the output down.

"Taking the op-amp's output voltage and coupling it to the inverting input is negative feedback."



Q 3 (b).

" The output of summing amplifier is positive"

This statment is true.

In non-inverting summing amplifier the output is positive.

Using the non-inverting amplifier input voltage are applied This input voltage are applied to the non-inverting input terminal and a part of the output is feedback to the inverting input terminal through bias feedback. And when the summing point of summing amplifier is connect with non-inverting input then it will give sum of the input voltage Also the input resistor are selected as

large as possible. if more input resistor are connected this allow the output voltage calculate easily. And these resistors are connected to the amplifier inverting input terminal