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

Course Details

Course Title: Electronic Circuit Design **Module:** 04
Instructor: Engr.Mujtaba Ihsan Sir **Total Marks:** 30

Student Details

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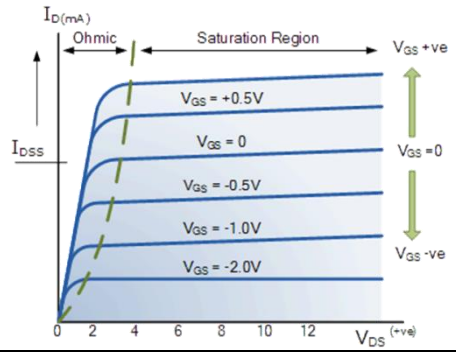
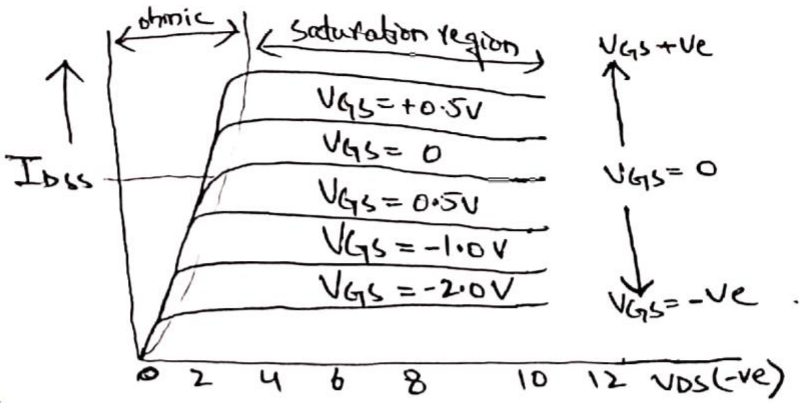
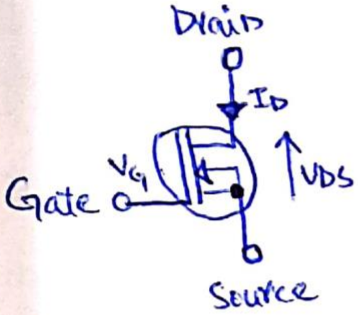
Q1.	(a)	**Explain** the drain characteristic curve of D-MOSFET given below. 	Marks 07 CLO 1
	(b)	**Sketch** the hybrid model and write equations for the transistor in common emitter configuration.	Marks 06 CLO 1
Q2.		A certain operational amplifier has a common mode gain of 0.6 and an open loop differential 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

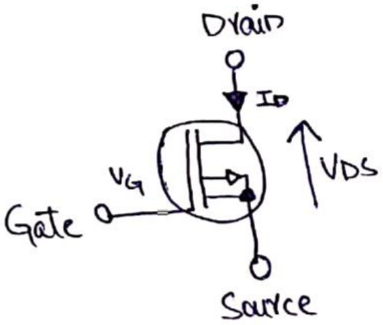
Q1 (a) :- Explain the drain characteristic curve of D-MOSFET given below



Ans:-



N- channel



P- channel.

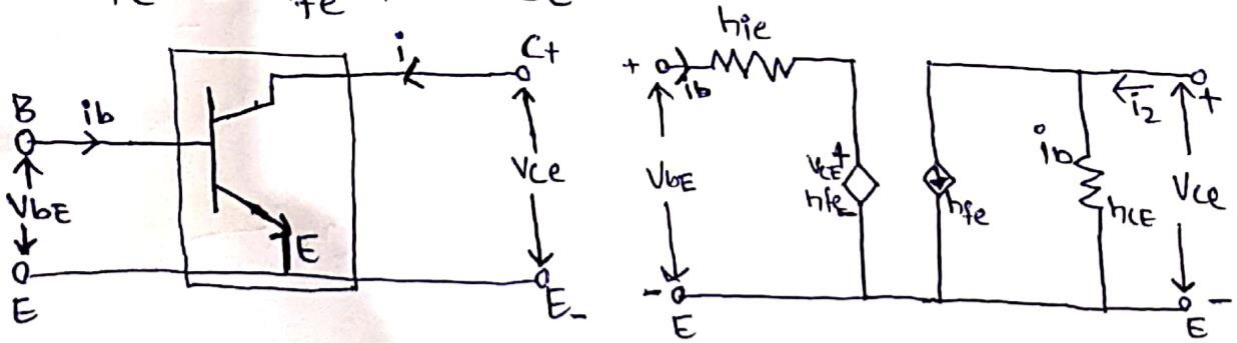
The characteristic mainly gives the relationship b/w drain-source voltage (V_{DS}) & Drain current (I_D). The small voltage at the gate controls the current flow through the channel. The channel b/w drain & source acts as a good conductor with zero bias voltage at gate terminal. The channel width & drain current increases if the gate voltage is possitive & these two decreases if the gate voltage is negative.

Question # 1 Part (b) :- Sketch the hybrid model & write equations for the transistor in common emitter configuration?

Answer :- In common emitter transistor configuration the input signal is applied b/w the base & emitter terminals of the transistor & output appears b/w the collector & emitter terminals. The input voltage (V_{be}) & output current (i_c) are given.

$$V_{be} = h_{ie} \cdot i_b + h_{re} \cdot V_c$$

$$i_e = h_{fe} \cdot i_b + h_{oe} \cdot V_c$$



where, $h_{ie} = (\partial f_1/\partial i_B)V_c = (\partial V_B/\partial i_B)V_c = (\Delta V_B/\Delta i_B)V_c = (V_b/i_b)V_c$

$h_{re} = (\partial f_1/\partial v_c)I_B = (\partial V_B/\partial V_c)I_B = (\Delta V_B/\Delta V_c)I_B = (V_b/V_c)I_B$

$h_{fe} = (\partial f_2/\partial i_B)V_c = (\partial i_c/\partial i_B)V_c = (\Delta i_c/\Delta i_B)V_c = (i_c/i_b)V_c$

$h_{oe} = (\partial f_2/\partial v_c)I_B = (\partial i_c/\partial v_c)I_B = (\Delta i_c/\Delta v_c)I_B = (i_c/v_c)I_B.$

Question #2:- A certain operational amplifier has a common mode gain of 0.6 & an open loop differential voltage gain of 40,0000.
Evaluate the CMRR & express it in decibels.

Solution:- Given data

$A_{ol} = 400,000$

$A_{cm} = 0.6$

Required

→ CMRR = ?

formula: As $CMRR = \frac{A_{ol}}{A_{cm}}$

→ Therefore $CMRR = 400,000 / 0.6$

$= \boxed{666,666.666}$

→ CMRR in describe:

→ Formula

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

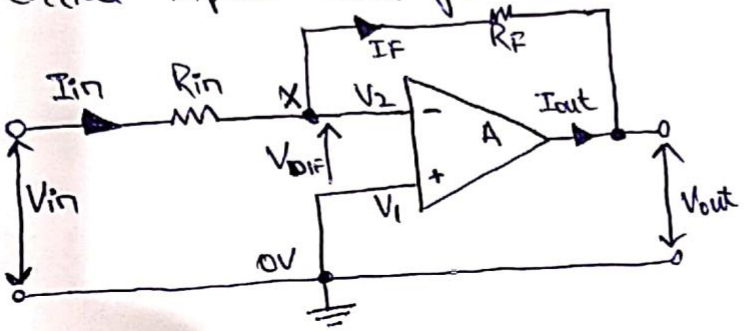
$= 20 \log (666,666.666)$

$\boxed{= 116.478 \text{ dB}}$

Answer.

Question# 3 part (a) :- Explain the concept behind negative feedback in operational amplifiers.

Answer :- Negative feedback is the process of "feeding back" a fraction of the output signal back to the input, but to make the feedback negative, we must feed it back to the negative or "inverting input" terminal of the op-amp using an external feedback resistor called Rf. This feedback connection blw the output & the inverting input terminal forces the differential input voltage towards zero.



Question #3 Part (b) :- State the following statement as True or False & also give the reason for your answer.

Answer :- The answer is "TRUE"

When the summing point is connected to the non-inverting input of the op-amp, it will produce the Positive Sum of the input voltages. This allows the output voltage to be easily calculated if more input resistors are connected to the amplifier inverting input terminal.