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

Course Details

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

Student Details

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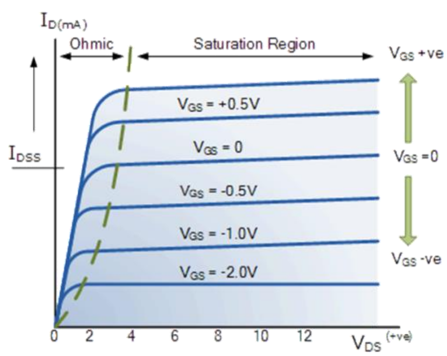
Q1.	(a)	**Explain** the drain characteristic curve of D-MOSFET given below. 	Marks 07 CLO 1
	(b)	**Sketch** the hybrid model and write equations for the transistor in common emitter configuration.	Marks 06 CLO 1
Q2.		A certain operational amplifier has a common mode gain of 0.6 and an open loop differential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

Answer to question 1(a):

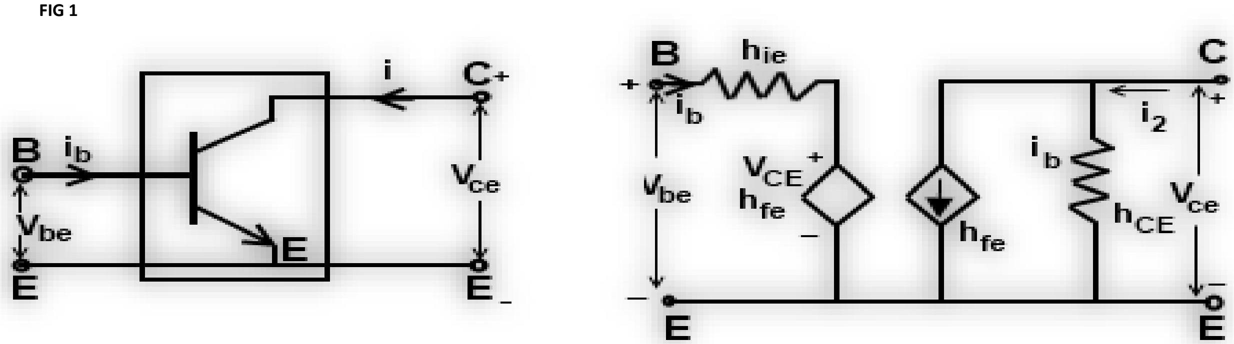
Drain characteristics are the characteristics between the drain current Id and the voltage vds for various voltage vgs if we see Id, vds and vgs we will find that the id is the output current, vds is the output voltage and vgs is the input voltage. Y axis is for the drain current Id in milli amperes (mA) and X axis is for the voltage vds in volts. the voltage vds in volts. The figure shows that initially the vds is at zero potential so the drain current Id is also at zero potential. As we increase the vds the drain current Id starts increasing linearly. Now at a certain value of vds the id becomes constant, it is because of the pinch off. Here vgs is 0volts. In depletion type MOSFETS we can increase and decrease the vgs. In the graph when the vgs is increased to =0.5v we can see that the drain current Id also increases. It is because the gate terminal becomes positive and attracts more electrons and as a result the drain current Id increases. Now when the vgs is decreased to -0.5v and so on we can see that the Id also decreases. It is because the gate terminal becomes negative and repels the electrons hence Id decreases. And if in case the vgs becomes equal to pinch off then the Id will be zero at any value of vds.

In case of vgs=0v the saturated drain current which is the maximum drain current is called Idss as shown in figure.

Answer to Question 1(b):

In common emitter transistor configuration, the input signal is applied between the base and emitter terminals of the transistor and output appears between the collector and emitter terminals. The input voltage (V_{be}) and the output current (i_e) are given by the following equations:

FIG 1



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

$i_e = h_{fe}.i_b + h_{oe}.V_c$

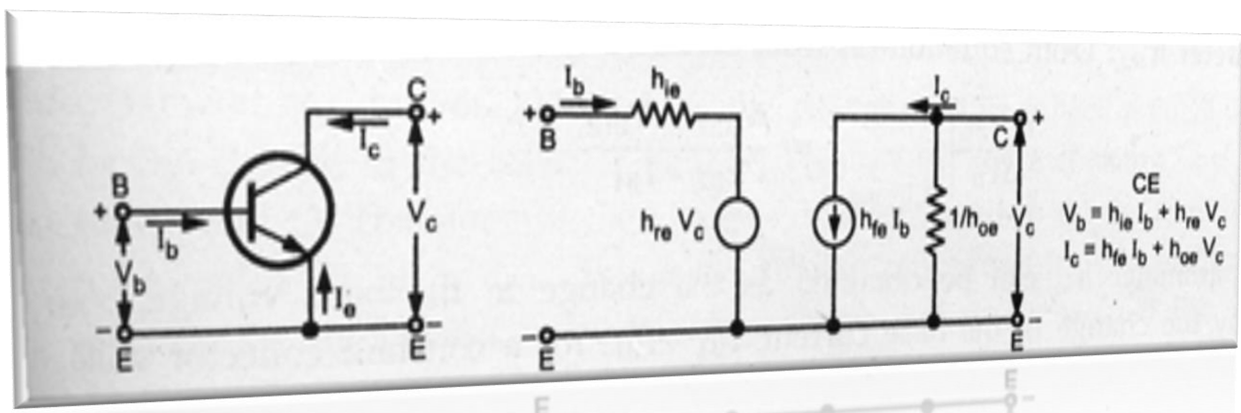
Where $h_{ie} = (\partial f_1/\partial i_B)V_c = (\partial v_B/\partial i_B)V_c = (\Delta v_B /\Delta i_B)V_c = (v_b / i_b)V_c$

$h_{re} = (\partial f_1/\partial v_c)I_B = (\partial v_B/\partial v_c) I_B = (\Delta v_B /\Delta v_c) I_B = (v_b /v_c) I_B$

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

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

FIG 2



Answer to question 2:

Given:

Aol=Open loop differential voltage gain= 400000

Acm=Common mode gain=0.6

Required:

CMPR=?

Solution:

FORMULA: CMPR=Aol/Acm

Therefore

CMPR=400000/0.6

=666666.666

CMPR in decibels:

Formula:

CMPR=20log(Aol/Acm)

=20log(666666.666)

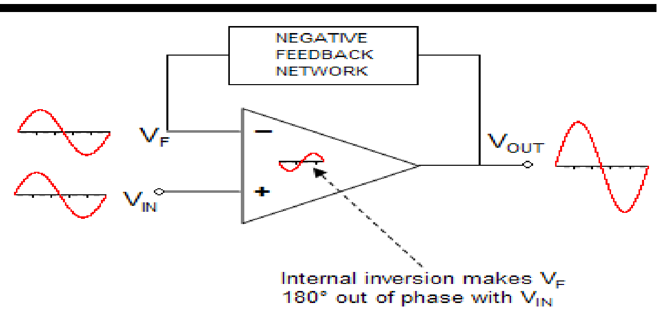
=116.47 dB

Answer to question 3 (a):

Negative feedback is the process whereby a portion of the output voltage of an amplifier is returned to the input with a phase angle that opposes (or subtracts from) the input signal.

Inverting (-) input effectively makes the feedback signal 180’ out of phase with the input signal.

A negative feedback amplifier is an amplifier that subtracts a fraction of its output from its input, so that the negative feedback opposes the original signal, the applied negative feedback can improve its performance (gain stability, linearly, frequency response, step response) and reduces sensitivity to the parameter variations due to malfunctioning or environment. Because of these advantages, many amplifiers and control system use negative feedback.



Answer to question 3 (b):

The statement is not true. The reason is that whenever the summing point is connected to the inverted input of the operational amplifier the circuit will produce the negative sum of any number of input voltages. Similarly, when the summing point is connected to the non-inverting input of the operational amplifier a positive sum of all the input voltages will be produced.