Course Title: Electronic Circuit Design

Instructor: Mujtaba Ihsan

Semester: 4th

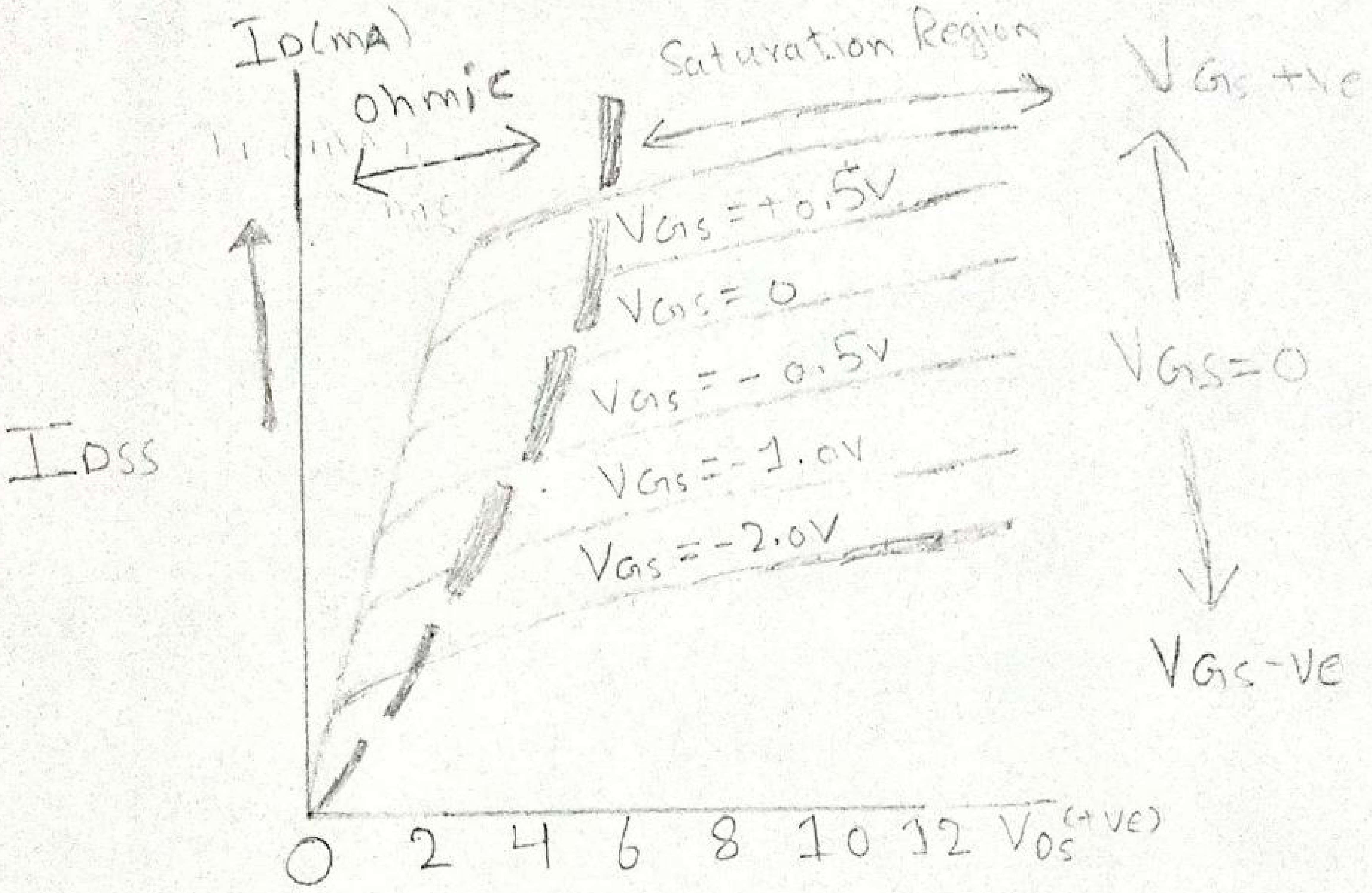
Student Name: Abdul Basit Khan

Student ID: 14564

Student Signature: ABasit

Q.1 (a)

Explain the drain characteristic curve of D-MOSFET given below.



Ans: Drain Characteristics is the characteristic between drain current and voltage V_{DS} for various voltage V_{GS}

As I_D is the output current and V_{DS} is the output voltage and various voltage is the input voltage

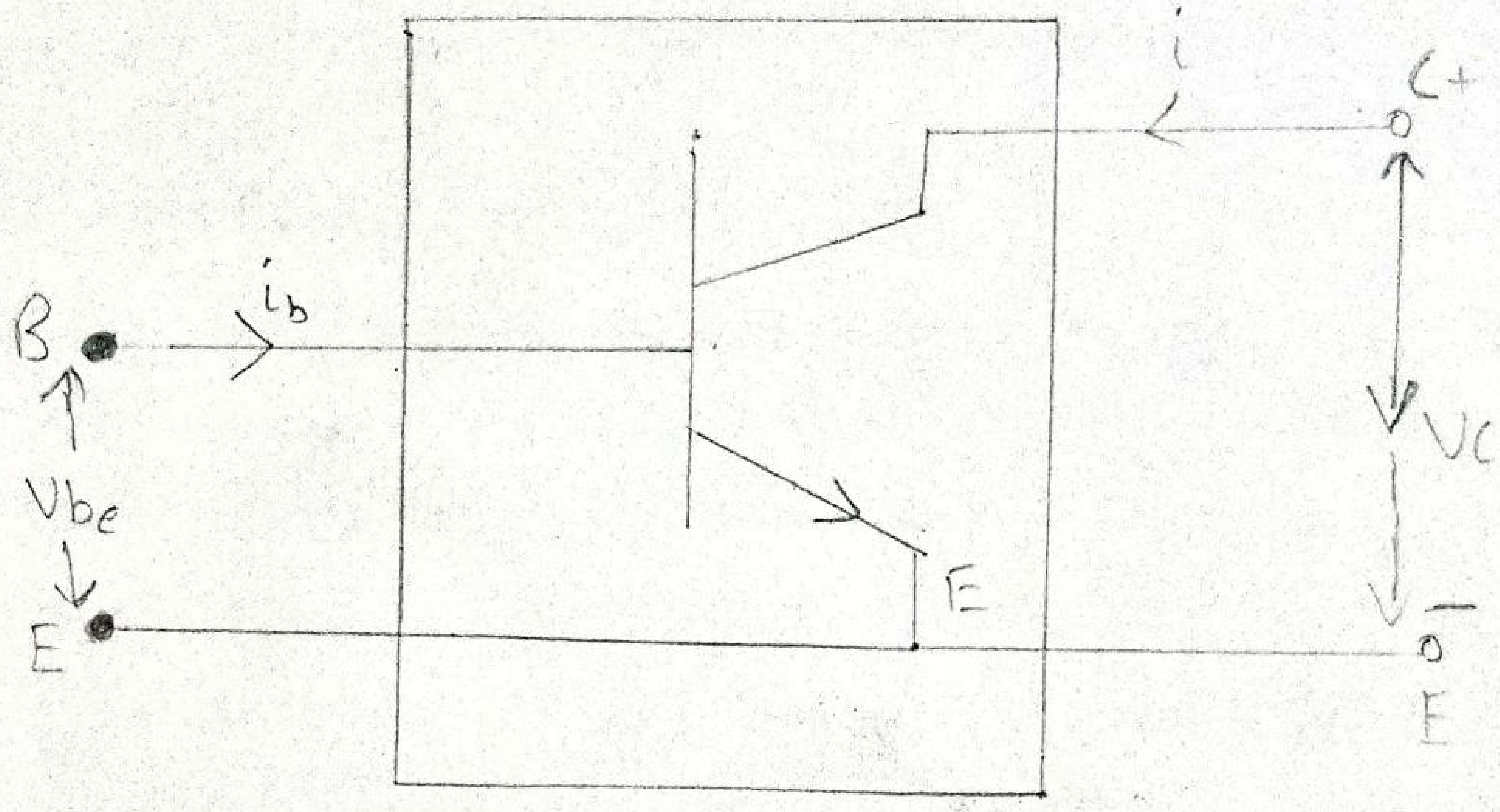
- when V_{DS} is increased I_D will also increase
- when $V_{GS}=0$ the pinch off occurs
- when we increase V_{GS} Positive i.e 0.6v the gate terminal becomes Positive the free Charge Carrier electron in P type is attracted toward the gate and the Channel will have more electron So the current will increase

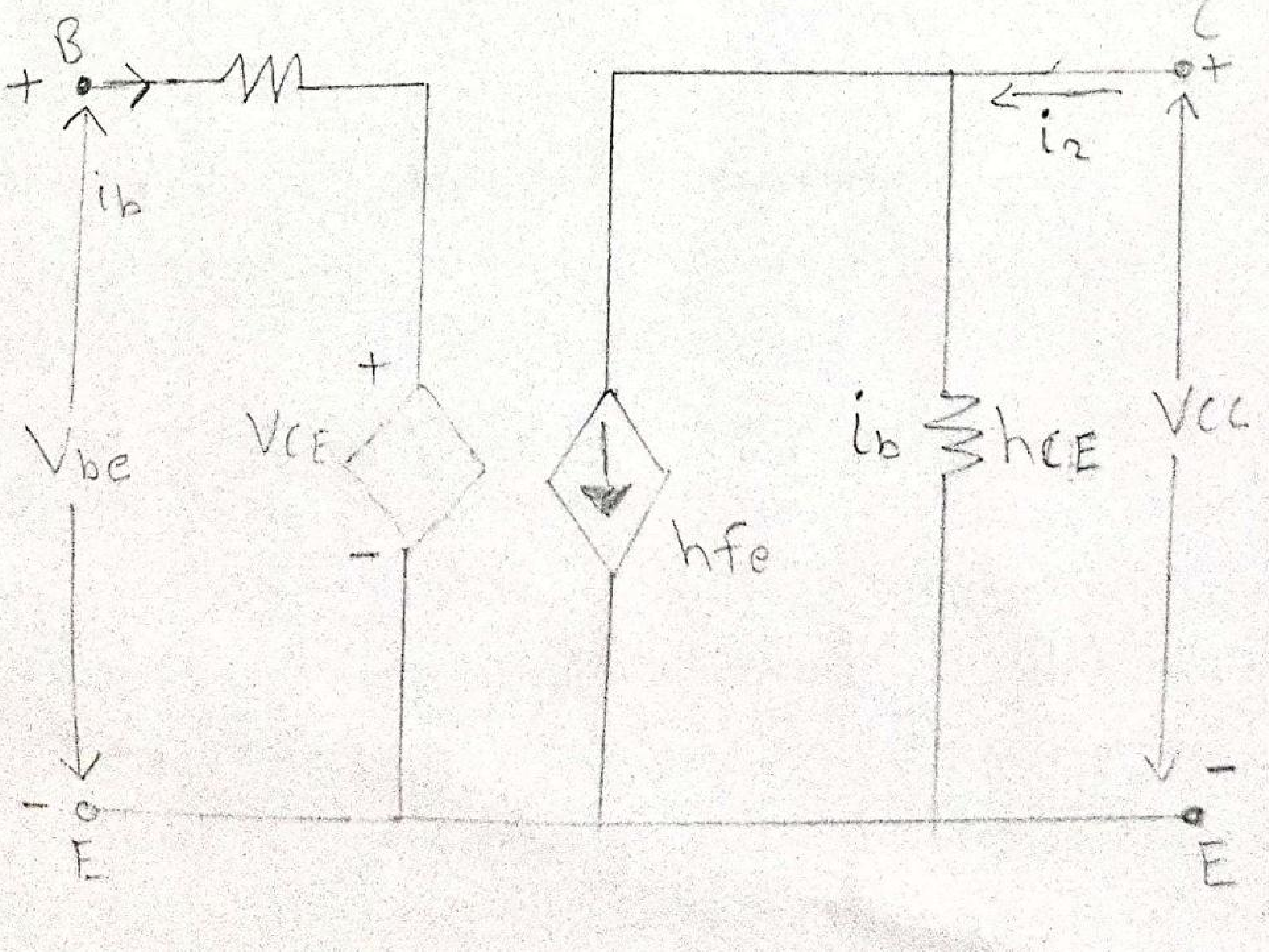
So increase in V_{GS} cause I_{DS} increase

Q1 (b)

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

Sol





The common emitter transistor configuration

The input signal is applied between the base and emitter terminal of the transistor and output appears between the collector and emitter terminal. The input voltage (V_{be}) and the output current (i_e) are given by the following equation

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

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

Transistor Hybrid Model (CE configuration

where

$$h_{ie} = (2f_1 / 2i_B) V_c = (2V_B / 2i_B) V_c =$$

$$(\Delta V_B / \Delta i_B) V_c = (V_b / i_b) V_c$$

$$h_{re} = (2f_1/2V_C)I_B = (2V_B/2V_C)I_B$$

$$= (\Delta V_B/\Delta V_C)I_B = (V_b/V_C)I_B$$

$$h_{fe} = (2f_2/2i_B)V_C = (2i_C/2i_B)V_C$$

$$= (\Delta i_C/\Delta i_B)V_C = (i_C/i_b)V_C$$

$$h_{oe} = (2f_2/2V_C)I_B = (2i_C/2V_C)I_B$$

$$= (\Delta i_C/\Delta V_C)I_B = (i_C/V_C)I_B$$

The same theory is extended to other configurations including CB and CC.

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.

Sol:

Given data

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

A_{CM} = Common mode gain = 0.6

Required:

CMRR = ?

Solution:

Formula

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

$$= \frac{400,000}{0.6}$$

$$= 666666.6667$$

$$= 666666.67$$

CMRR in decibels

Formula

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

$$= 20\log(666666.6667)$$

$$= 116.48\,dB$$

Q 3 (a)

Explain the concept behind negative feedback in operational amplifiers.

Ans

Negative feedback

Negative feedback is the Process where by 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 feed back 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 feed back opposes the original Signal, the applied negative feedback can improve its Performance (gain stability linearly, frequency response, step response) and reduce sensitivity to the Parameter Variations due to malfunctioning. Because of these advantages many amplifiers and control system uses negative feed back.

3 (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".

Ans: The statement is False, because when 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 voltage likewise, when the summing input is connected to the non inverting input of the operational amplifier it will produce the positive sum of the input voltage