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Date: ______ **Mid-Term** MON ☐ TUES ☐ WED ☐

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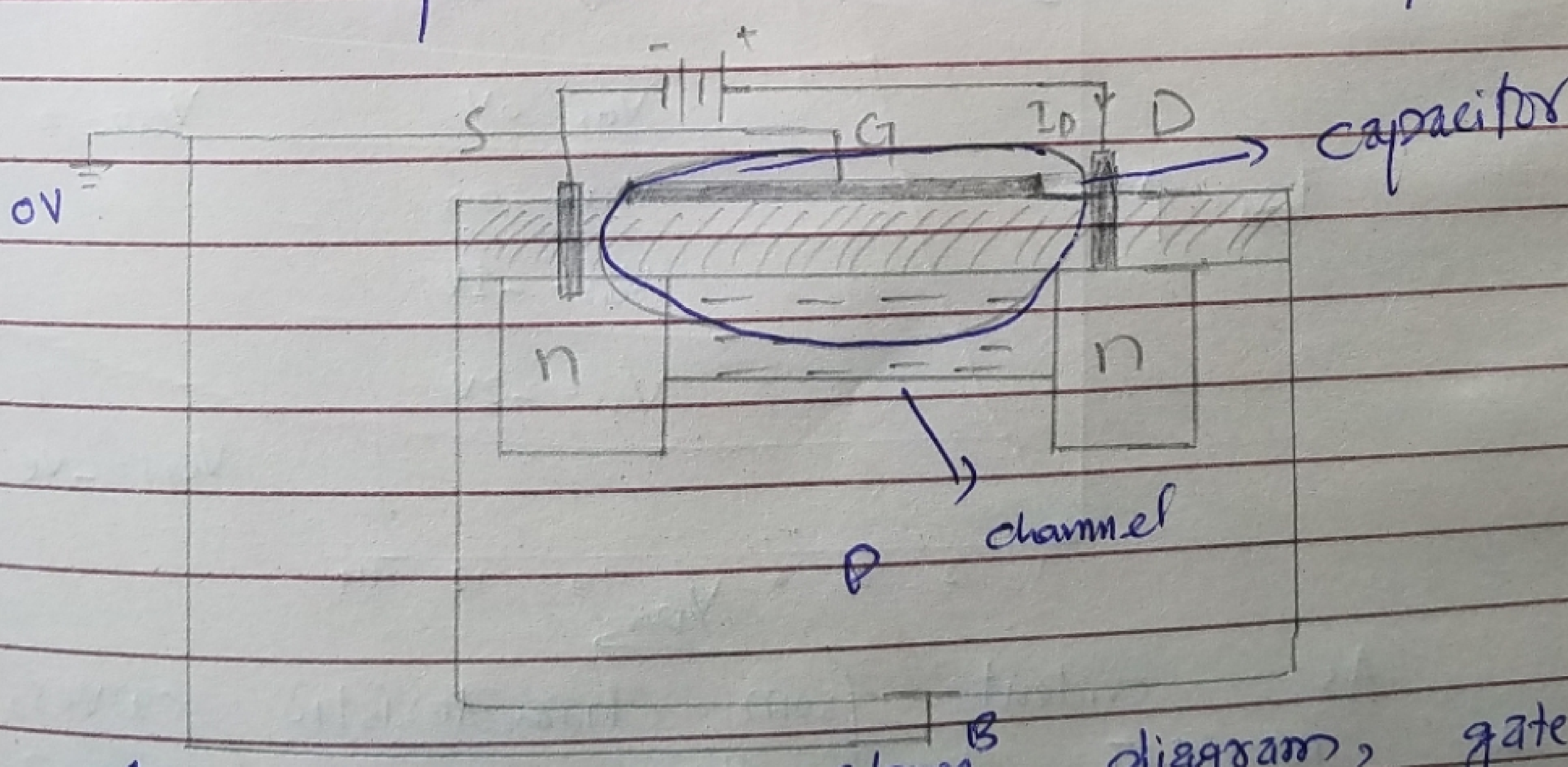
Subject: Electronic Circuit Design

Q No. 1:- Explain drain characteristic curve of D-MOSFET?

Answer—:

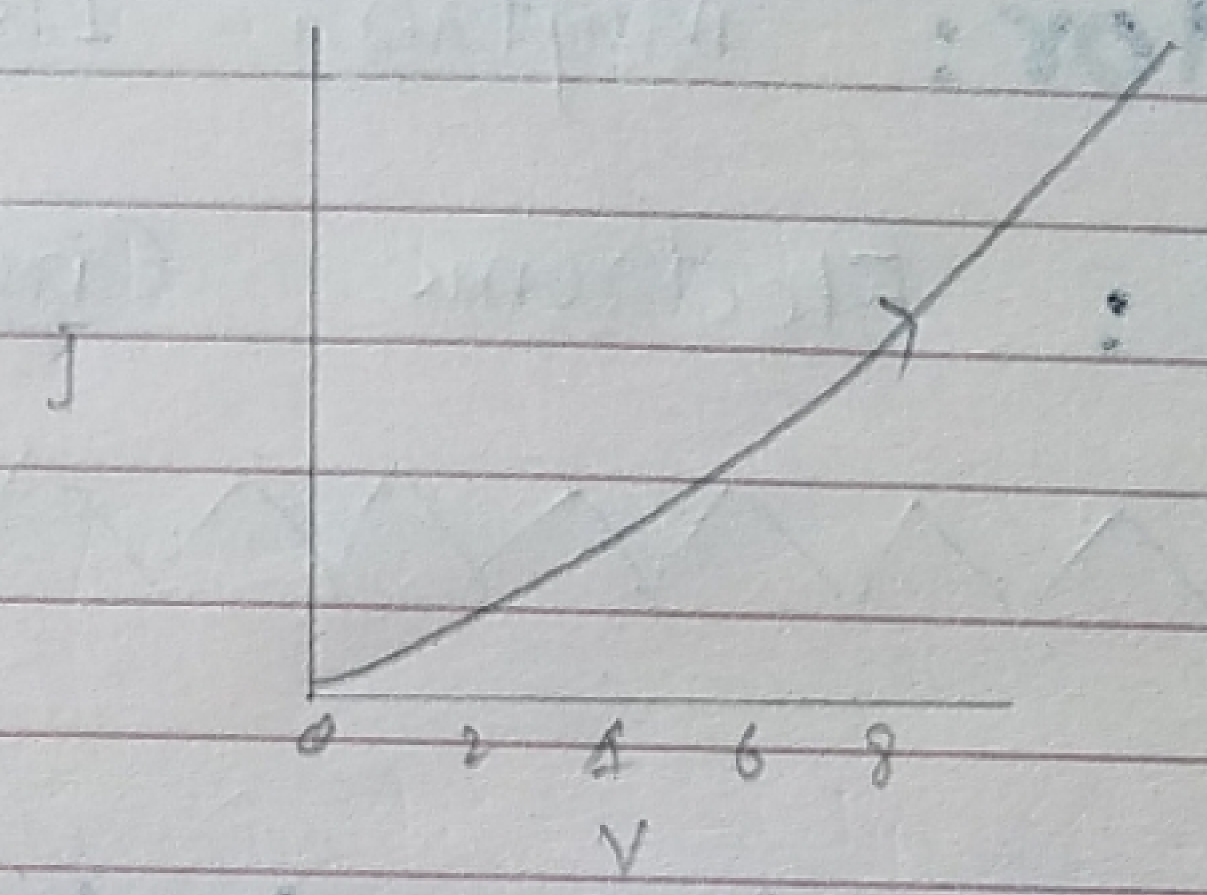
D-Type Mosfet:-

A depletion type mosfet has a channel permanently fabricated at the time of its construction itself.

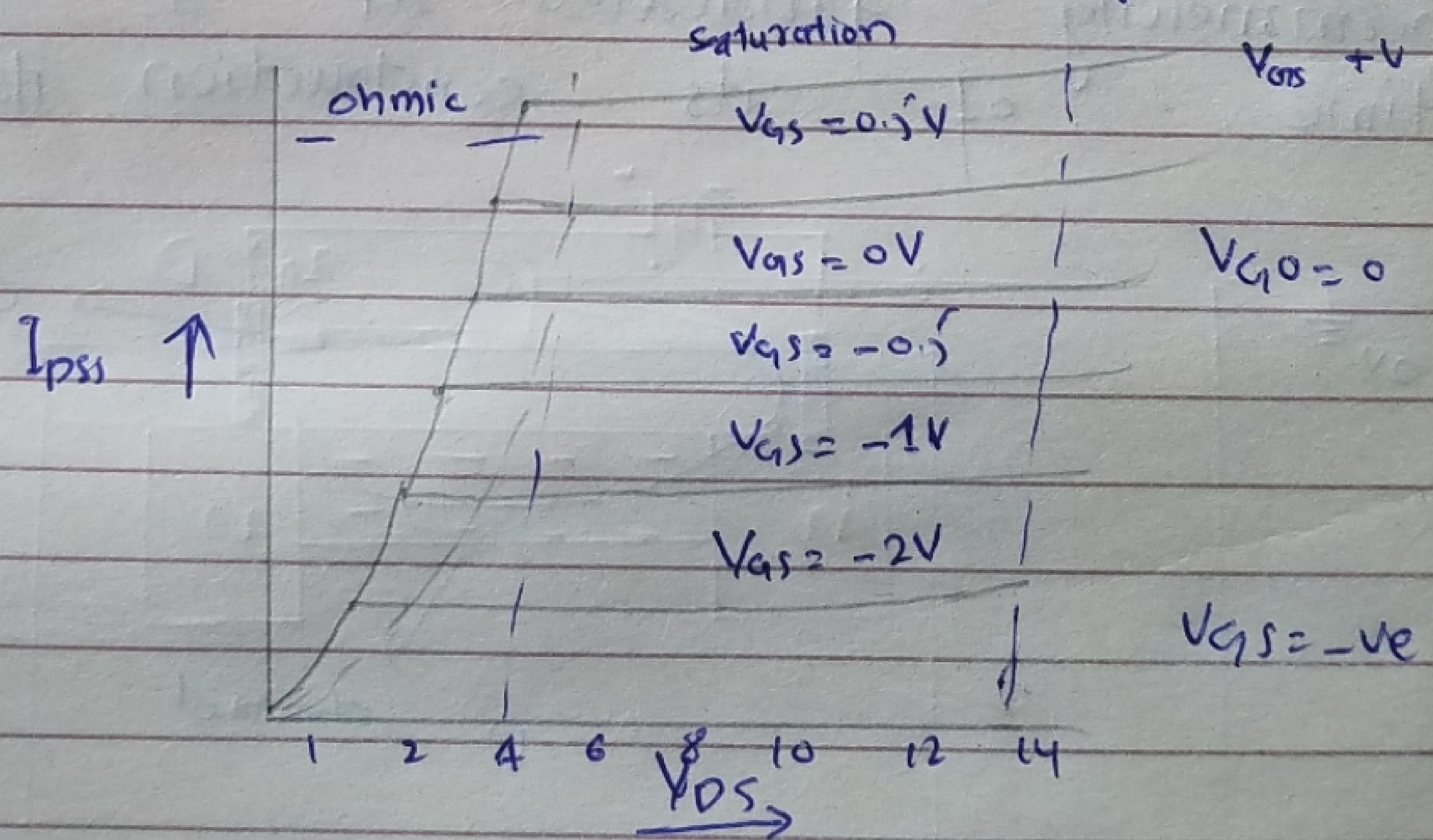


As shown in above diagram, gate to-source voltage is set to zero by shorting gate and source. V_{DS} is applied between drain and source.

Since $V_{GS} = 0$, no change in capacitor and no change in channel.
Lets set $V_{GS} = -1$. Capacitor charges and channel should positive.



Depending upon magnitude of V_{GS}, electrons and holes recombine will reduce the number of free electrons available for conduction. As we keep increasing the nagative V_{GS}, I_{DS} keep decreasing and finally become zero at particular V_{GS}, which is known as pinch-off voltage.



As evident from characteristic curves, a MOSFET has three operating region,

1) Cut-Off :- In cutt-off region, the circuit behave like an open circuit.

2) Ohmic / Linear region →

In ohmic, I_{DS} increases with increase in V_{DS}.

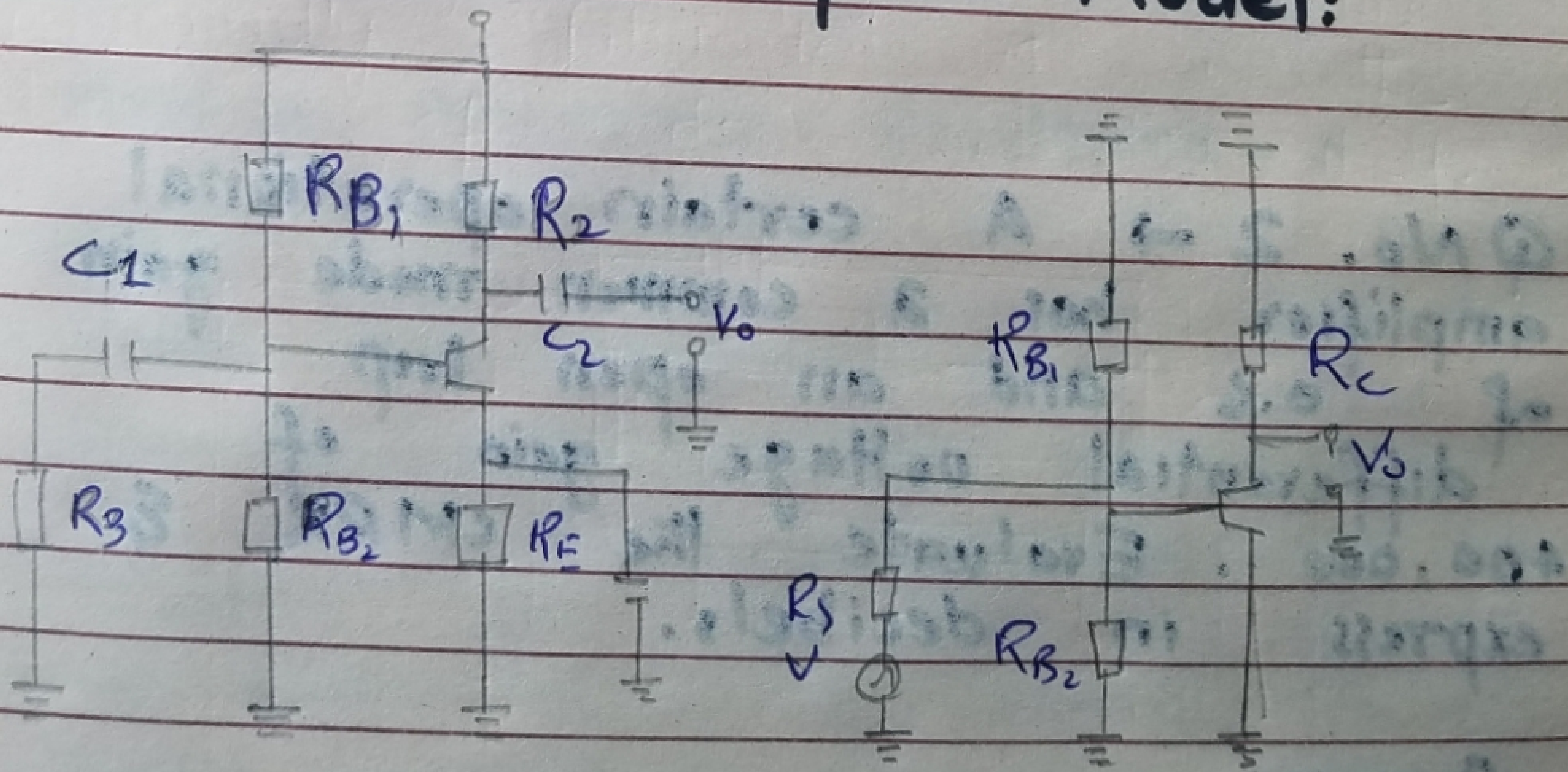
3) Saturation region →

In this I_{DS} is constant inspite of increas in V_{DS}.

Q No.1 Par (b)

Sketch hybrid model and write equation for transister in common emitter configuration.

Ans:- Transister Hybrid Model:



Equation for transister CE :-

In common emitter transister configuration, the input signal is applied between the base and emitter terminals of transister and output appears between the collector and emitter terminals. The input voltage and output current are given below:

$$V_{be} = hie \cdot i_b + hre \cdot V_c$$

$$i_e = h_{fe} \cdot I_b + hoe \cdot V_c$$

Current Gain:

$$A_i = -(h_{fe} / (1 + hoe \cdot r_L))$$

Input Resistance:

$$R_i = hie + hre \cdot A_i \cdot r_L =$$
$$= hie - ((hre \cdot hfe) / (hoe + (1/r_L)))$$

Q No. 2 → 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 in decibels.

Answer:

Given:-

Open differential voltage = 400,000
common mode gain = 0.6

Req:

CMRR = ?

Solution :-

using formula as

$$CMRR = \frac{V_{gain}}{\text{Common gain}}$$

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

$$CMRR = 666666.66$$

In decibel

$$\boxed{CMRR = 116.478 \text{ decibels}}$$

Q No. 3 Explain the concept behind negative feedback in operational amplifiers.

Ans :- Nagative feedback - :

Nagative feedback is the process of " feeding back " a fraction of the output signal back to the input, but to make the feedback nagative or "inverting input" terminals " of the op-amp using an external feeback resister called R_f. This feedback connection between the output and inverting input terminal forces the differential input voltage twards zero.

Concept :- This effect produces

a closed loop circuit to the amplifier resulting in the gain of the amplifier now being called its closed loop Gain. Then a closed-loop inverting amplifier uses nagative feedback to accurately control the overall gain of the amplifier, but at a cost in the reduction of the amplifiers gain.

QNo.3 : State the following statement : True or False

"The output of a summing amplifier is positive".

Ans:- Note that when the summing point is connected to inverting input of the op-amp the circuit will produce the nagative sum of any number of input voltages. Likewise, 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.

So This statement is True.

Thank you.