VIVEKANANDA COLLEGE
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NAAC ACCREDITED 'A' GRADE

Topic: Depletion mode Mos-Fet

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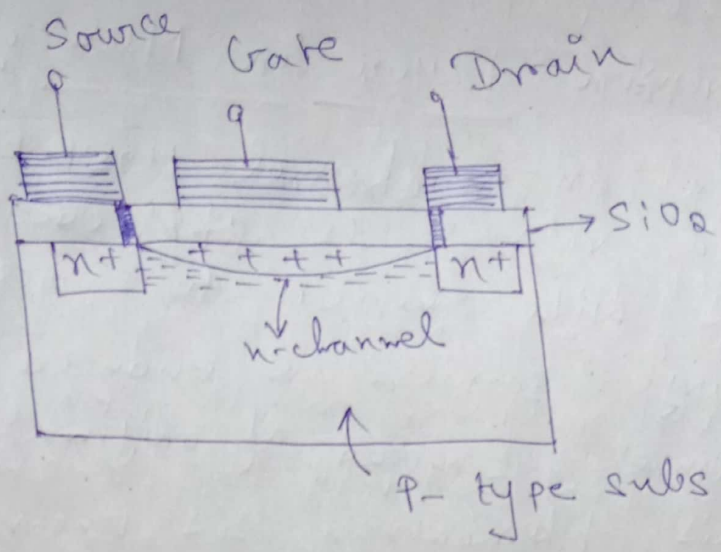
Name of the Department: Electronic Science

n- channel depletion MOSFET



Operation :- In depletion MOSFET, there is already an n-channel between two n+ regions so when the drain to source voltage increases, keeping V_{GS} '0', there is an increase in drain current with V_{DS} and finally it becomes saturate.

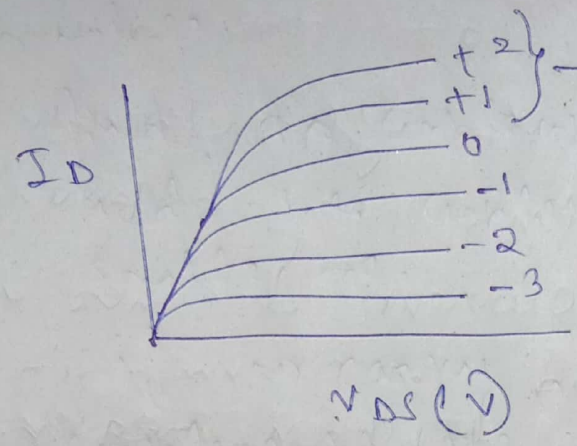
If V_{GS} is negative, due to capacitive action positive charges are accumulated below the SiO_2 layer and some majority carriers are depleted off, The region/channel. It reduces the channel conductivity and therefore drain current decreases. If gate voltage V_{GS} is at positive potential more and more majority carriers are accumulated in the channel, thereby increasing its conductivity and drain current increases with V_{DS}. This operation of the

device is known as enhancement mode of operation for depletion MOSFET

Inversion Layer in MOS :-

In an n-channel MOSFET when positive voltage is applied to the gate with respect to source, negative charge carriers are induced in the channel, instead of original carriers, This phenomenon is known as inversion

Drain characteristic of Depletion MOSFET :-



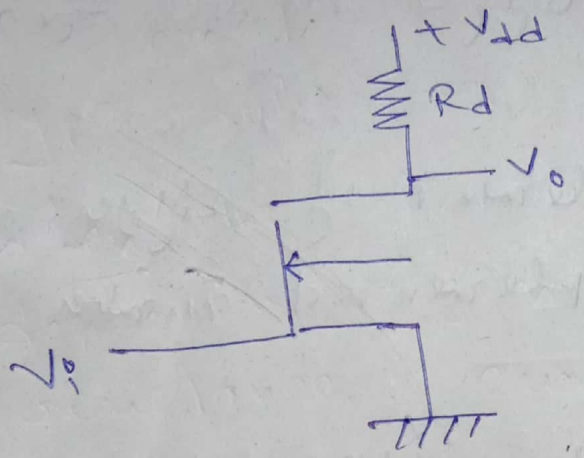
The graph shows the variation of drain current with drain-source voltage for constant gate-source voltage.

To explain the curve, we first consider $V_{GS}=0$, if V_{DS} gradually increases, the drain current almost increases linearly for small V_{DS}. The device acts as a simple resistor. This region is ohmic or linear region.

For sufficiently large value of V_{DS}, the channel gets pinch-off at the drain end and the carriers experienced high resistance, the current becomes saturate this part of the curve is called saturation region.

Depending on manufacturer specification if V_{DS} exceeds it's rated value, the device may damage.

MOSFET as a Switch :-



N-channel E-MOSFET (enhancement) as a switch.

In the given circuit, when the input voltage Vi is less than V_T. There is no channel is enduced between source and drain, and the device remain cutoff, the output voltage

$V_o = V_{DD}$ (High)

When Vi is greater than V_T. The device switches from cutoff to saturation and the drain current is developed across R_d, therefor the output voltage V_o become low.

Deference between (E-MOS) enhancement MOS and depletion MOSFET (D-MOS)

i) In D-MOSFET a channel is diffused between source and drain.

In E-MOSFET no such channel exist between source and drain.

ii) In normal condition, D-MOS some current flows even in absent of Gate-Source voltage.

In case of E-MOS a minimum V_{GS} is required to enduce the channel, there after current flows.

iii) D-MOSFET is normally an on-state device because of readymade channel.

E-MOS is off state, because threshold voltage (V_{th}) is required at gate to activate the device

iv) A D-MOS can be operated in ei' the depletion or enhancement mode.

E-MOS only can operate in enhancement mode.