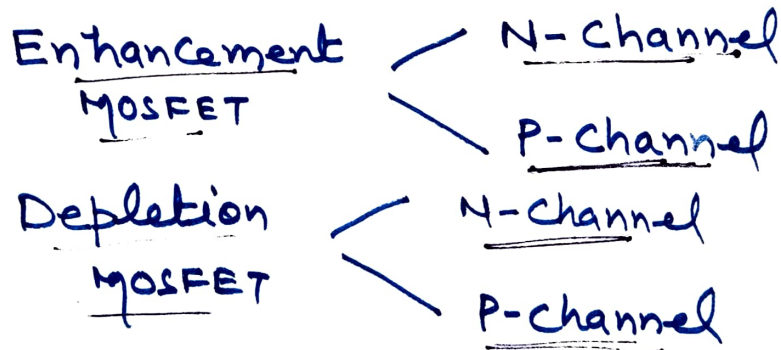


# MOSFET :-

Metal oxide Field Effect Transistor (MOSFET) is a type of Field Effect Transistor (FET) in which Gate is insulated from the channel. IGFET

Depending on the channel, whether it is enhanced or Permanently diffused, the MOSFET is further classified -



# Enhancement type MOSFET :-

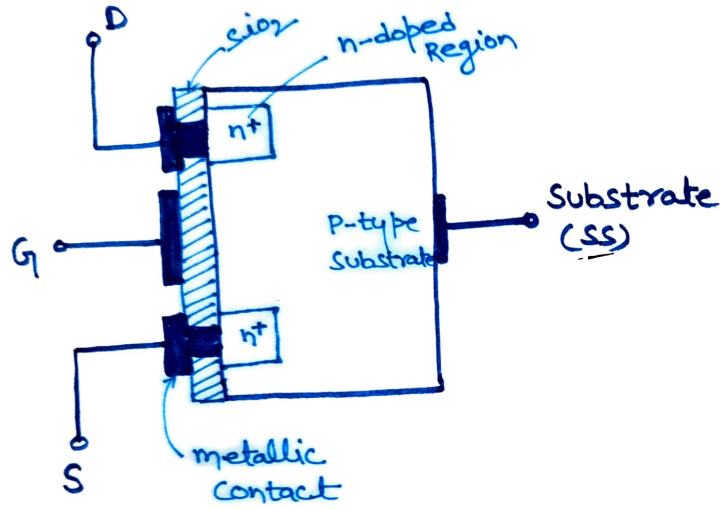
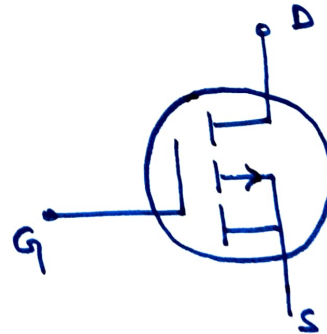
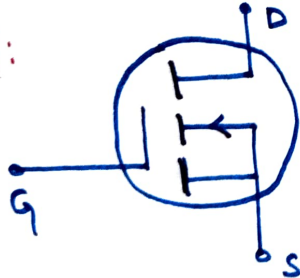


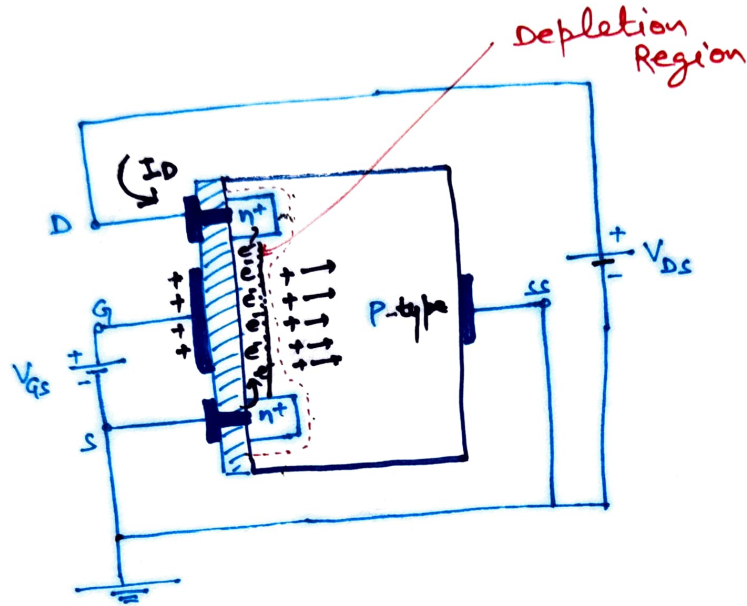
Fig. N-channel Enhancement MOSFET

Symbol:



P-channel

operation:-



→ If  $V_{GS} = 0V$  and  $V_{DS} = +ve$ , no current flow due to absence of channel.

→ If  $V_{GS} = +ve$ ,  $V_{DS} = +ve$

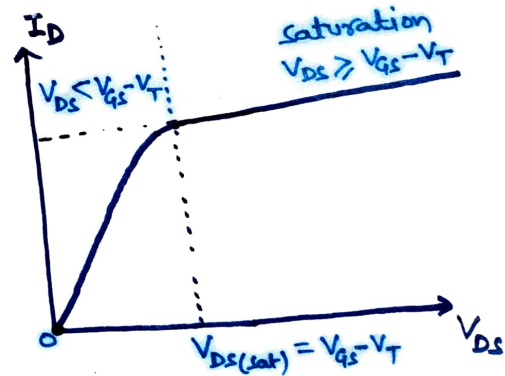
→ The level of  $V_{GS}$  at which the channel begins to conduct is called threshold voltage  $V_T$ .

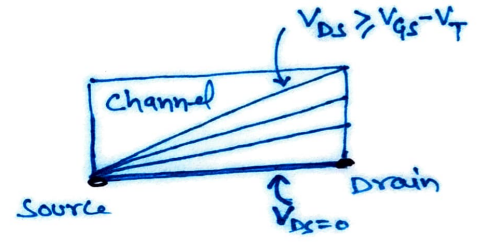
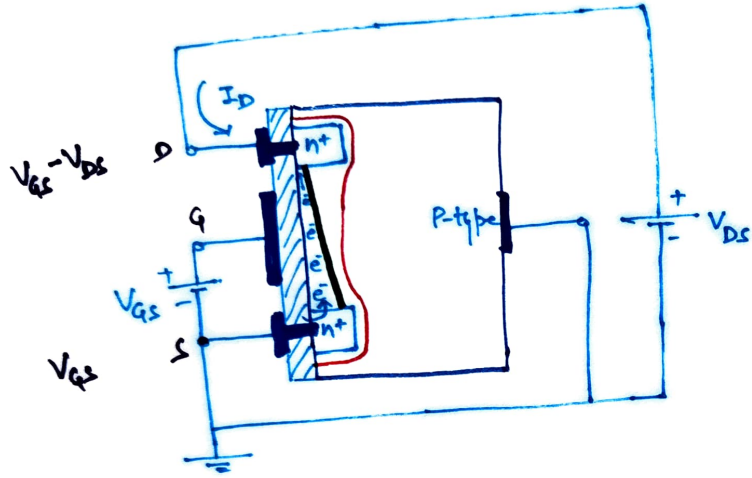
- Since the channel is non-existent with  $V_{GS} = 0V$  and it is enhanced by the application of a +ve gate to source voltage, this type of MOSFET is called as an enhancement type MOSFET.
- As  $V_{GS}$  is increased beyond the threshold level, the density of free carriers in the induced channel will increase resulting in an increased level of drain current.
- If we hold  $V_{GS} = \text{constant}$  and increase the level of  $V_{DS}$ , following conditions occur.

→ If  $V_{DS} < V_{GS} - V_T$ , Linear region  
 $I_D \uparrow$  with  $V_{DS} \uparrow$

→  $V_{DS} = V_{GS} - V_T$ , channel Pinched off.

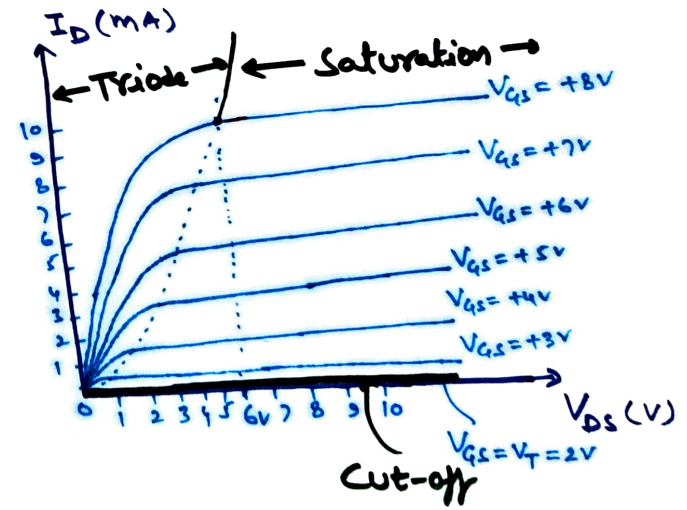
→  $V_{DS} \geq V_{GS} - V_T$ , Saturation Region  
 $I_D = \text{const}$ ,  $V_{DS} \uparrow$



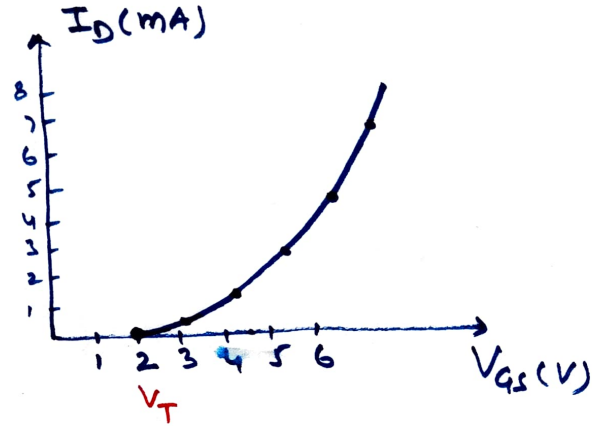


### Drain Characteristics:-

Cut-off:  $V_{GS} < V_T$   
 Triode Region:  $V_{DS} < V_{GS} - V_T$   
 Saturation:  $V_{DS} \geq V_{GS} - V_T$



Transfer characteristic:-



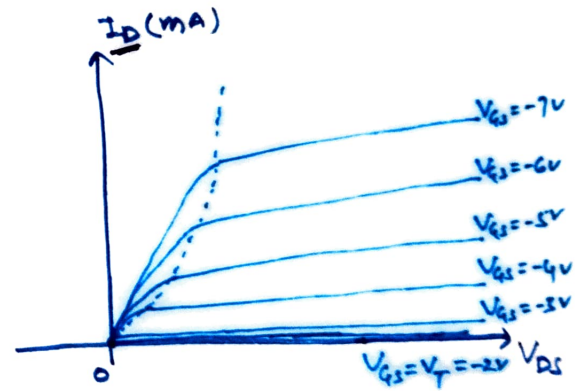
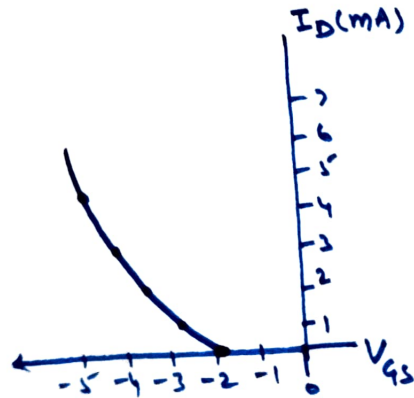
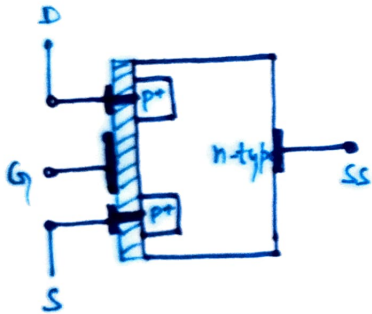
The Drain current is related to applied gate-to source voltage by the following Non-linear Relationship

$$I_D = K(V_{GS} - V_T)^2$$

where  $K$  is a constant.

# P-channel Enhancement type MOSFET:-

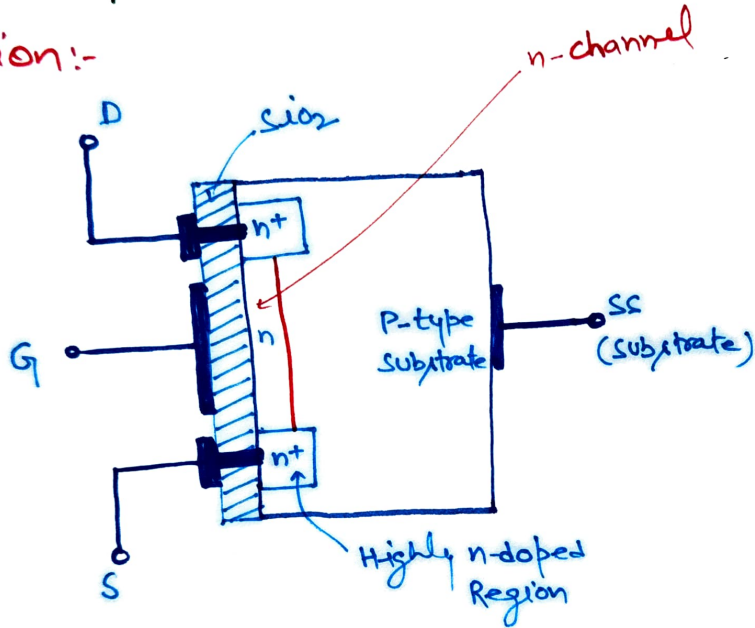
7



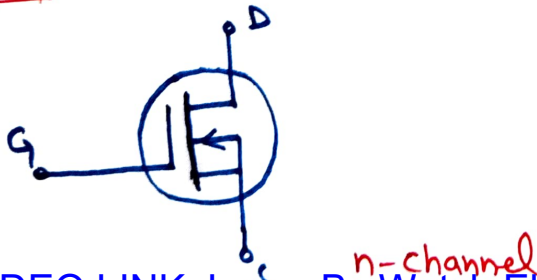


# Depletion type MOSFET :-

Construction:-

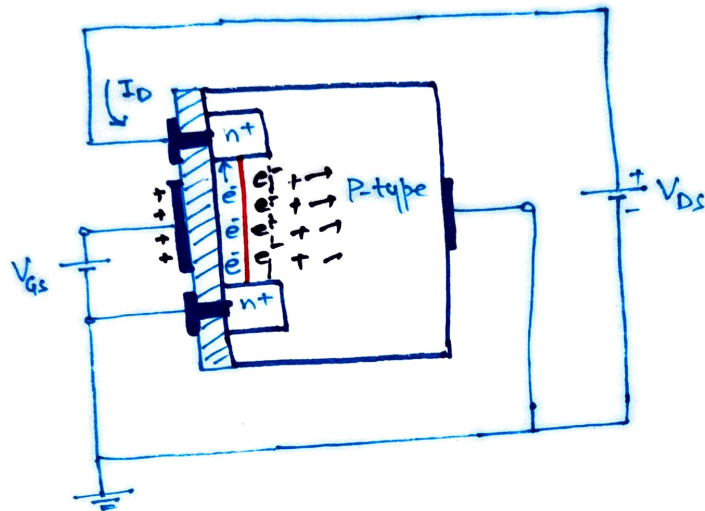


Symbol:





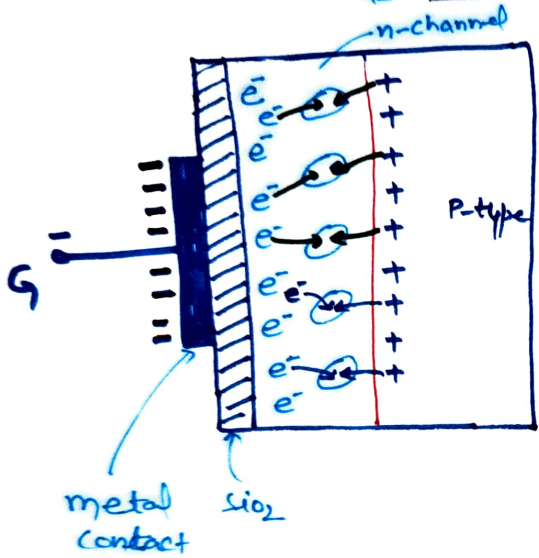
operation:-



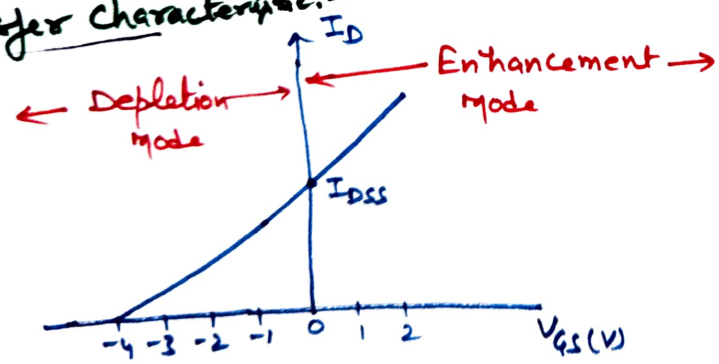
→ operation with  $V_{GS} = 0$  ,  $V_{DS} = +ve$

→ operation with  $V_{GS} = +ve$  ,  $V_{DS} = +ve$

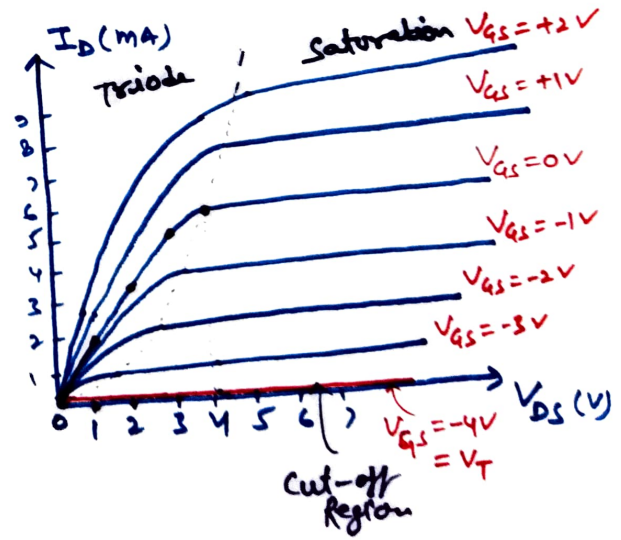
→ operation with  $V_{GS} = -ve$  ,  $V_{DS} = +ve$



Transfer Characteristic:-



Drain Characteristics:-



# P-channel Depletion Type MOSFET:-

(11)

