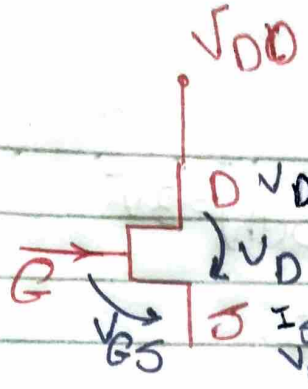
Sec 2:-

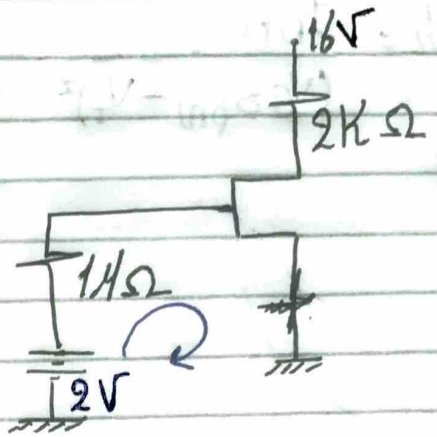
JFET



$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$

ex:- $V_P = -8\,V$

$I_{DSS} = 10\,mA$



* Determines ① the transfer characteristic curve.

2) I_D ؟

$V_S = 0$ $\therefore V_{GS} = V_G - V_S = V_G$

$2 = I_G R_G + V_{GS}$

$2 = V_G + V_G$ $\therefore 2 = 2V_G$ $\therefore V_G = 1\,V$

$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$ (2)

* $V_{GS} = V_P\left(1 - \sqrt{\frac{I_D}{I_{DSS}}}\right)$

MOSFET:-

Depletion.

$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$

Enhancement

* MOSFET

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

$$K = \frac{I_{Don}}{(V_{GS_{on}} - V_t)^2}$$

* $V_{GS(th)}$

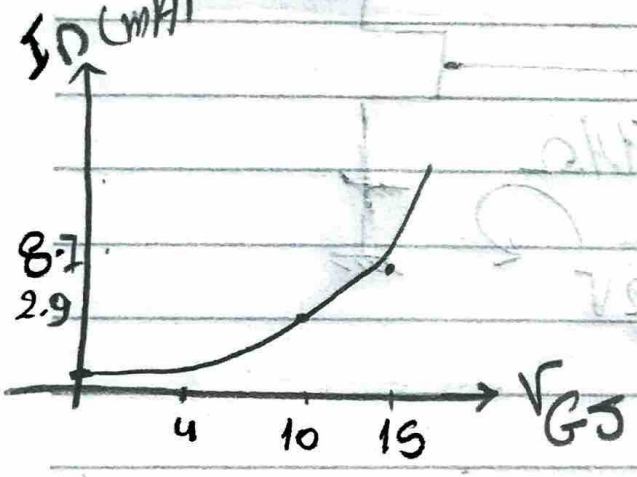
* $V_{GS(t)}$

Data:- $V_{GS(on)} = 10V$, $I_{D(on)} = 3mA$, $V_{GS(th)} = 3V$

Ref) ① K , ② the Transfer characteristic.

Sol

$$K = \frac{I_{D(on)}}{(V_{GS_{(on)}} - V_t)^2} = \frac{3*10^{-3}}{(10-3)^2} = \text{0,061} \; A/V^2$$



جزئي

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

V_{GS}	I_D
4	0,061 mA
10	2.9 mA
15	8.7 mA
20	17.6 mA

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Main differences between the FET and BJT :-

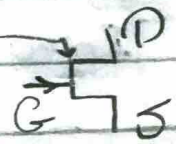
* the BJT transistor is a current-controlled device.
* the FET Transistor is a voltage-controlled device.

* the BJT → bipolar electrons و holes تعتمد على
* the FET → unipolar electrons أو holes تعتمد على

FET

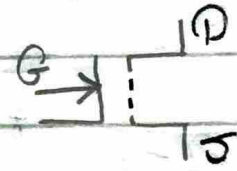
(JFET)

n-channel
p-channel

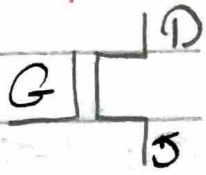


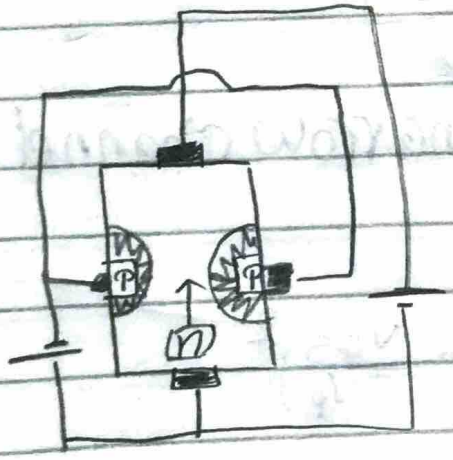
(MOSFET)

(Enhancement)



(Depletion)





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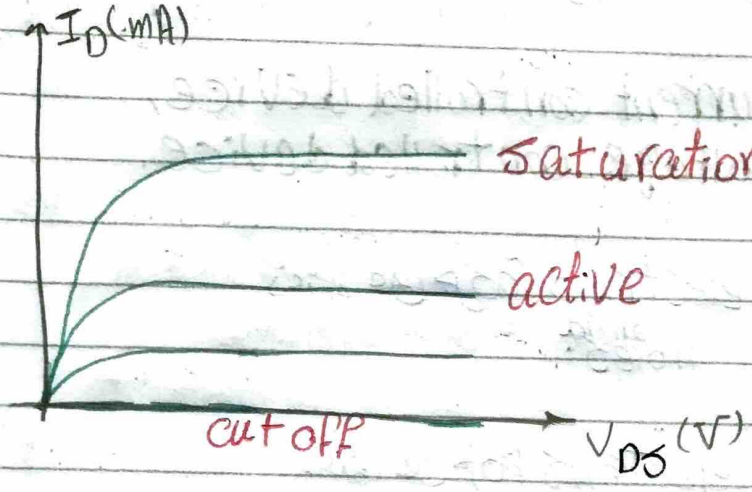
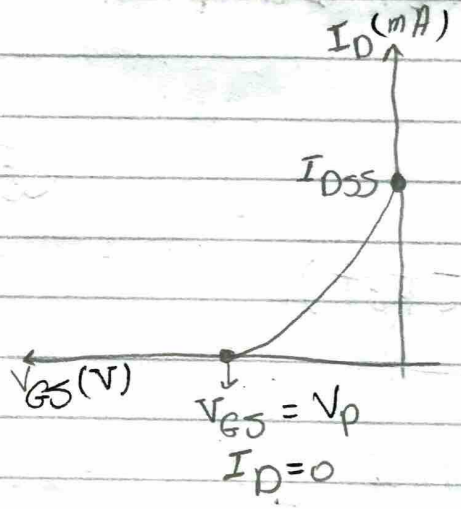
* characteristics curve for n-channel JFET



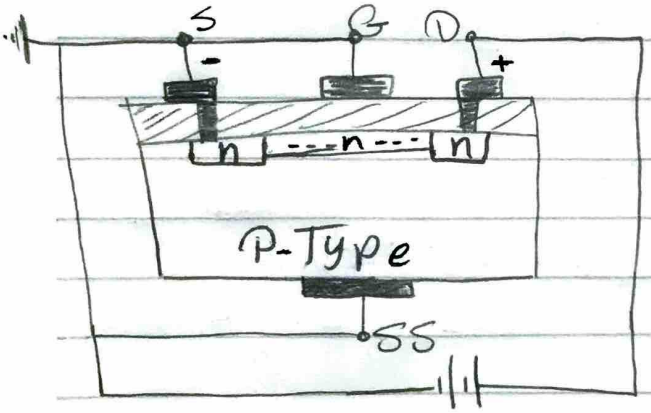
$$* I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$

$$V_{GS} = V_P\left(1 - \sqrt{\frac{I_D}{I_{DSS}}}\right)$$



→ Depletion-Type MOSFET :-

* The gate current (I_G) is essentially zero
* The drain and source connected by a narrow channel.



$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$

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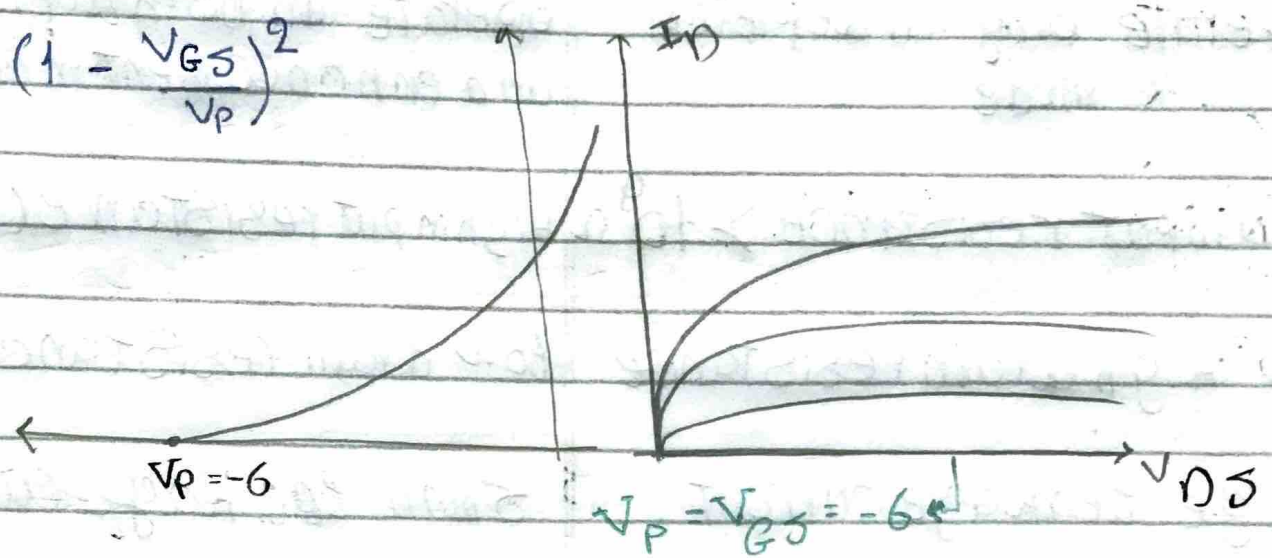
Characteristics curve for n-channel D-MOSFET

$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$

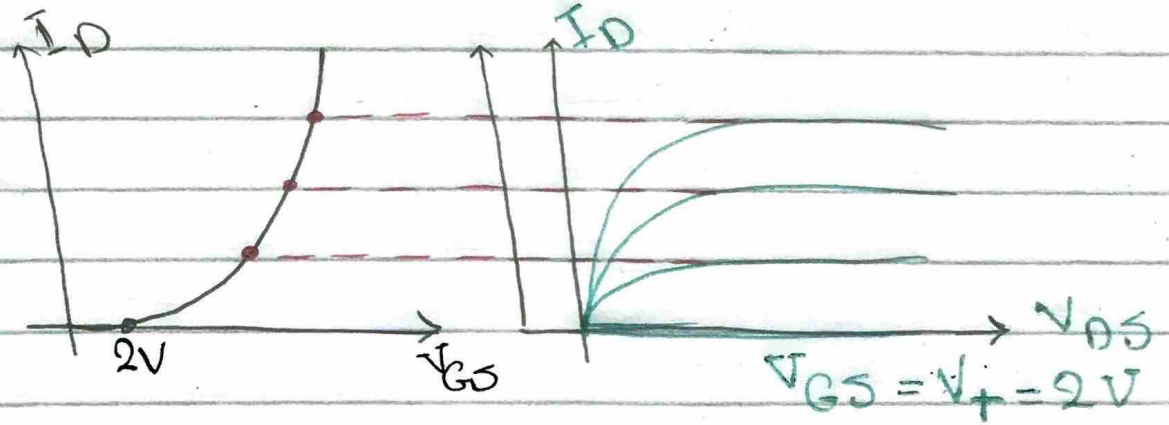


*Enhancement-MOSFET:-

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

ثابت

$$*K = \frac{I_{D(on)}}{(V_{GS_{(on)}} - V_t)^2}$$



JFET	MOSFET
operate only in depletion mode	operate in both depletion and enhancement mode
low input resistance $> 10^9 \Omega$	High input resistance ($10^{13} \Omega$)
~~to~~ High drain resistance	low drain resistance
large leakage current	small leakage current
Not easy construction	easy construction