University of Anbar
College of Engineering
Dept. of Electrical Engineering



# Fundumantal of Electronic II

## Second Class

Chapter 6 : Field Effect Transistors
Lec06_p2

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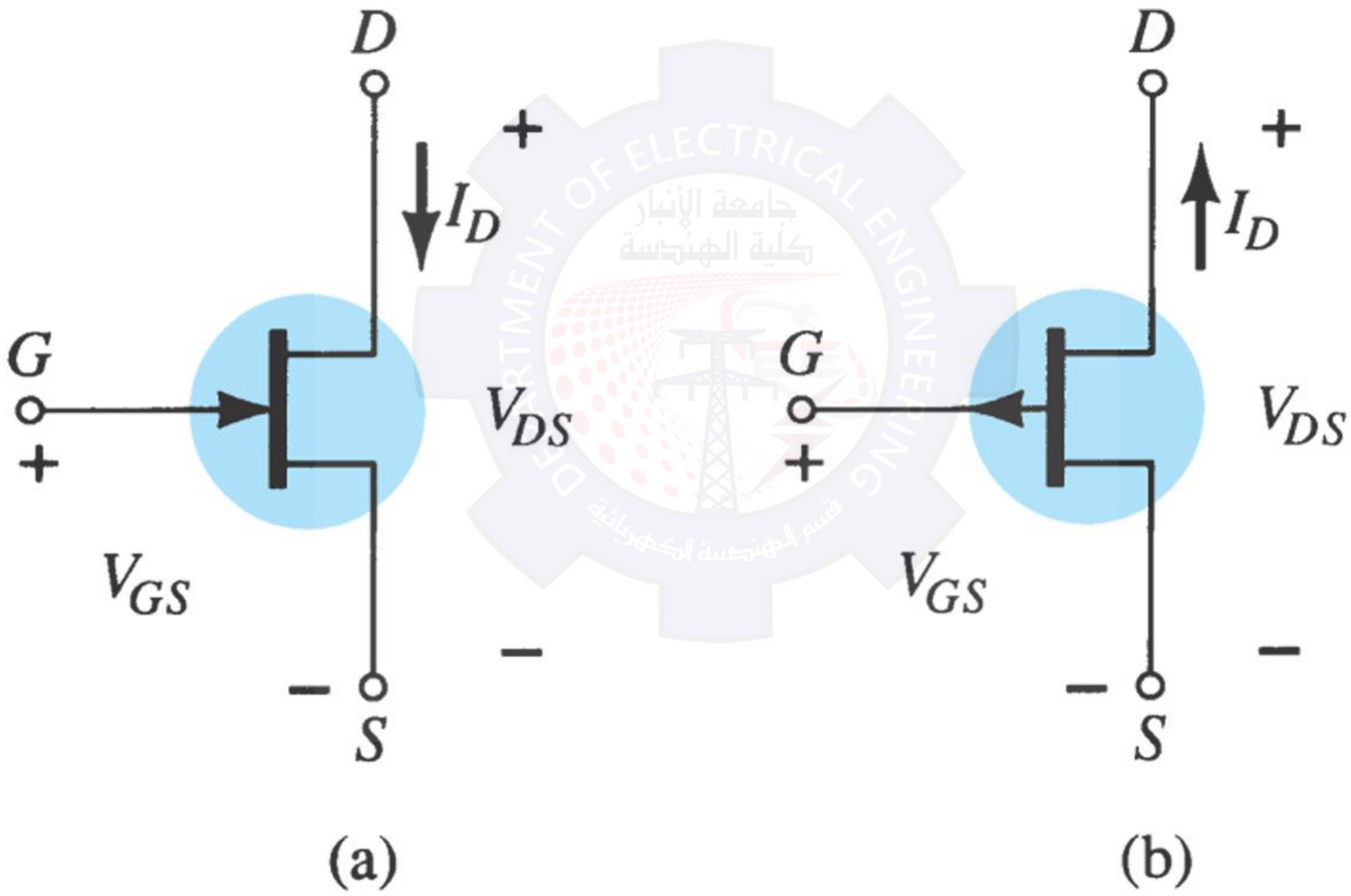
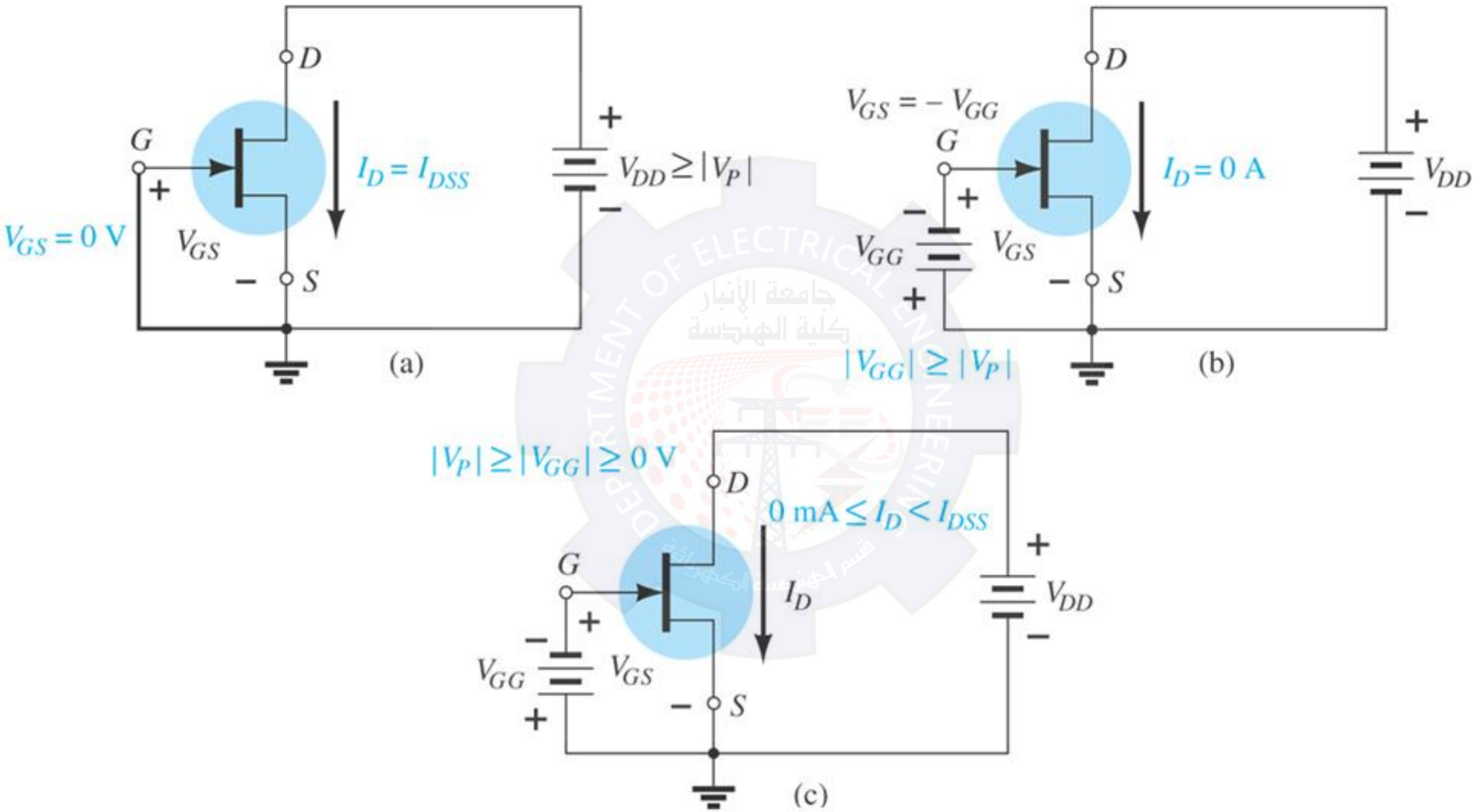
# JFET Symbols




JFET symbols: (a) n-channel; (b) p-channel.



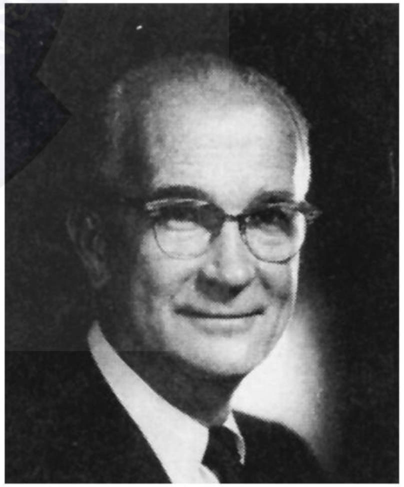

(a) $V_{GS} = 0$ V, $I_D = I_{DSS}$; (b) cutoff ($I_D = 0$ A) $V_{GS}$ less than (more negative than) the pinch-off level; (c) $I_D$ is between 0 A and $I_{DSS}$ for $V_{GS} \leq 0$ V and greater than the pinch-off level.

# JFET Transfer Characteristics

In a BJT, β indicates the relationship between $I_B$ (input) and $I_C$ (output).

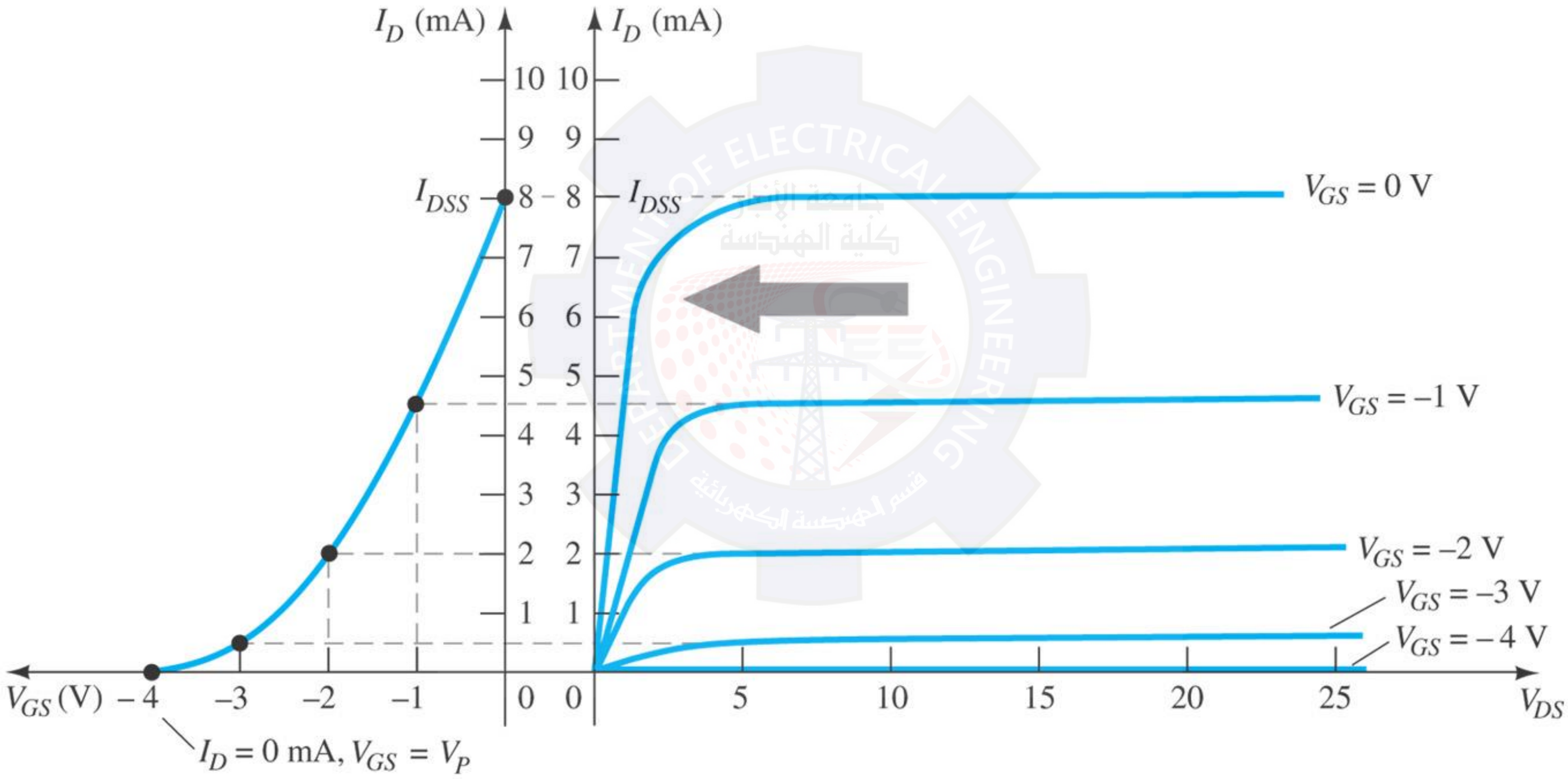
In a JFET, the relationship of $V_{GS}$ (input) and $I_D$ (output) is a little more complicated (*Shockley's equation*):

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



William Bradford Shockley
(1910–1989)

# JFET Transfer Curve




**This graph shows the value of $I_D$ for a given value of $V_{GS}$.**

# Plotting the JFET Transfer Curve

Using $I_{DSS}$ and Vp ($V_{GS(off)}$) values found in a specification sheet, the transfer curve can be plotted according to these three steps:

### Step 1

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

**Solving for $V_{GS}$ = 0V** $I_D = I_{DSS}$

### Step 2

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

**Solving for $V_{GS} = V_p$ ($V_{GS(off)}$)** $I_D = 0A$

### Step 3

**Solving for $V_{GS}$ = 0V to $V_p$**

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

**i.e. For $V_{GS}$ = -1 V**

$$I_D = 8mA\left(1 - \frac{-1}{-4}\right)^2 = 4.5\text{mA}$$

Conversely , for a given $I_D$, $V_{GS}$ can be obtained:

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

# Example 6.1

Sketch the transfer curve defined by $I_{DSS}$=12 mA and $V_P$=-6V.

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

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