University of Anbar
College of Engineering
Dept. of Electrical Engineering

Fundumantal of Electronic II

Second Class

Chapter 7 : FET Biasing

Lec07_p1

Munther N. Thiyab

2019-2020

Basic Current Relationships

For all FETs:

$$I_G \cong 0A$$

$$I_D = I_S$$

For JFETS and D-Type MOSFETs:

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

For E-Type MOSFETs:

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

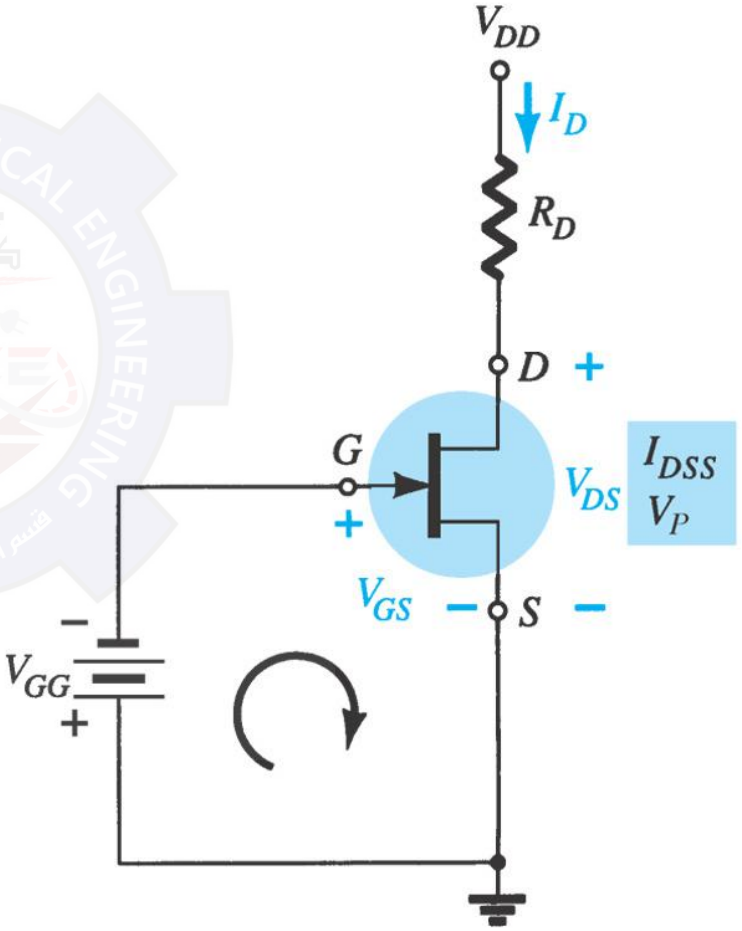
Fixed-Bias Configuration

$$I_G \cong 0A$$

$$V_{DS} = V_{DD} - I_D R_D$$

$$V_S = 0, \quad V_D = V_{DS}, \quad V_{GS} = -V_{GG}$$

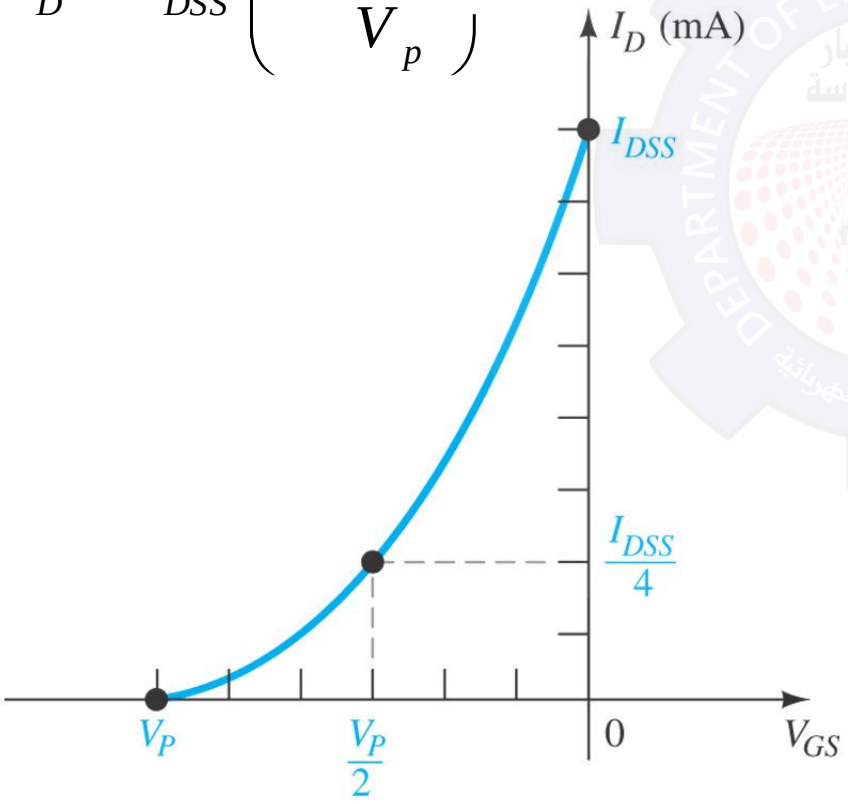
$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_p}\right)^2$$



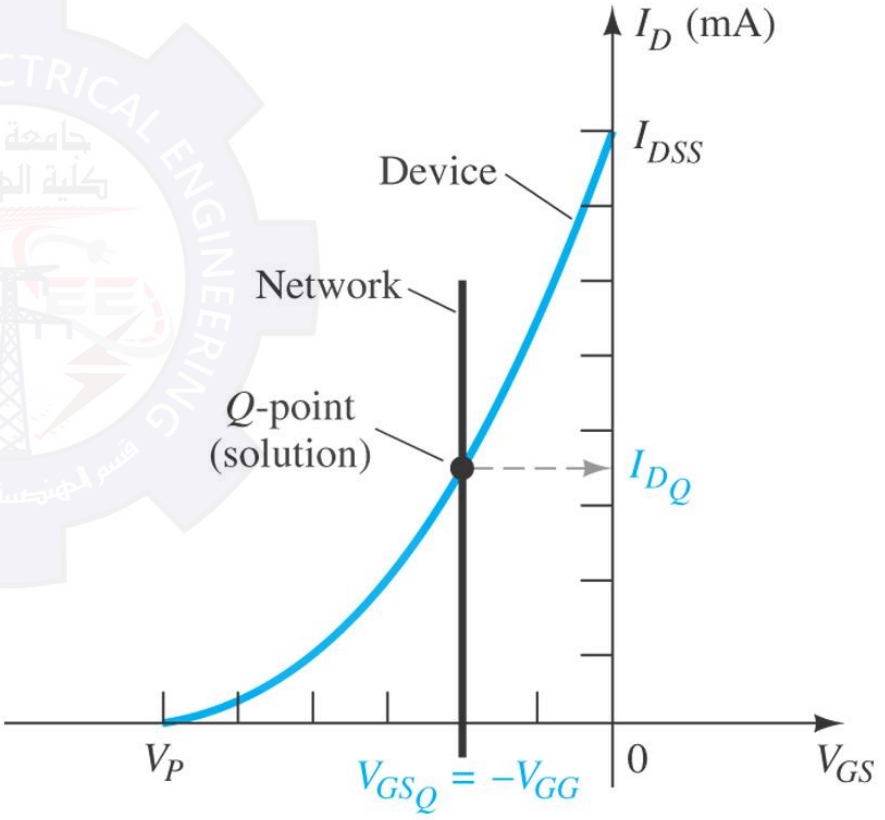
Network for dc analysis.

Fixed-Bias Configuration –Graphical Solution

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



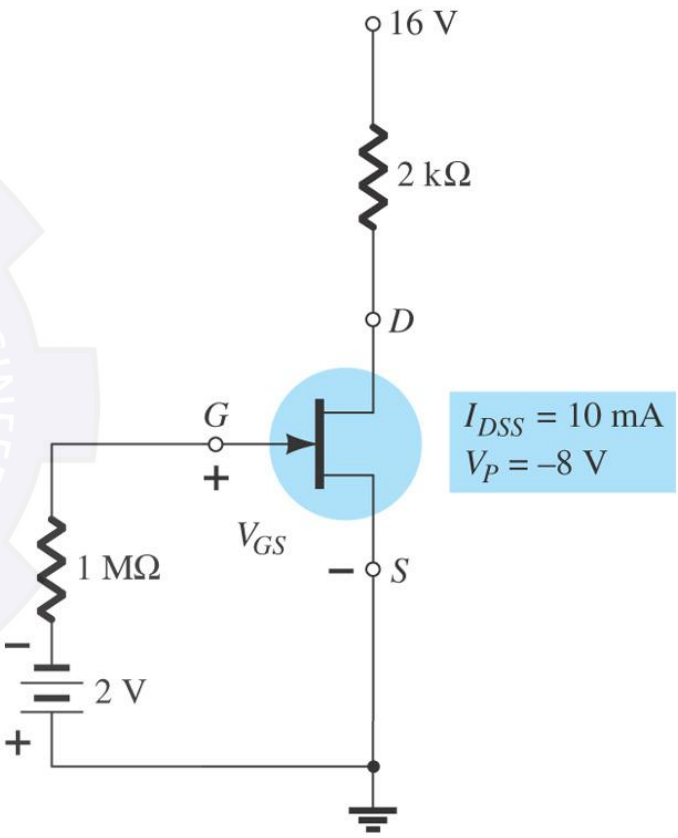
Plotting Shockley's equation.



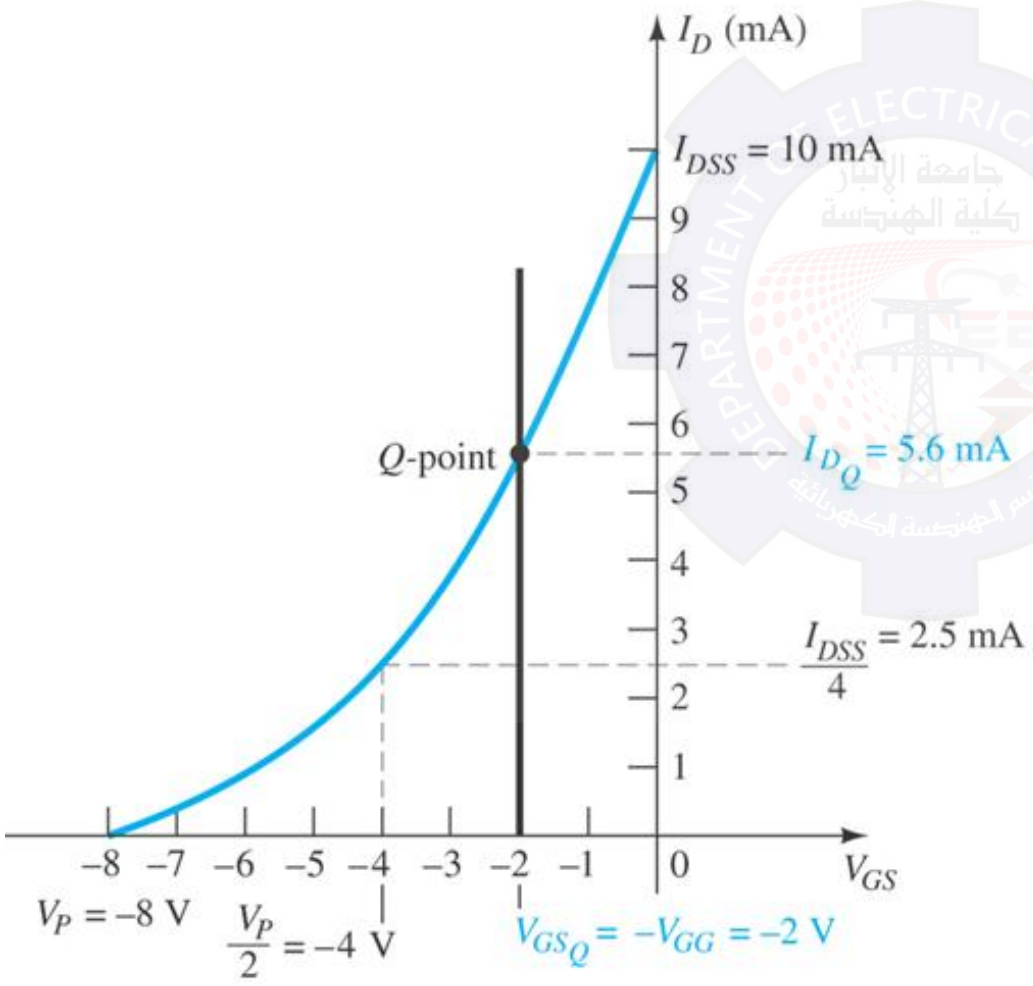
Finding the solution for the fixed-bias configuration.

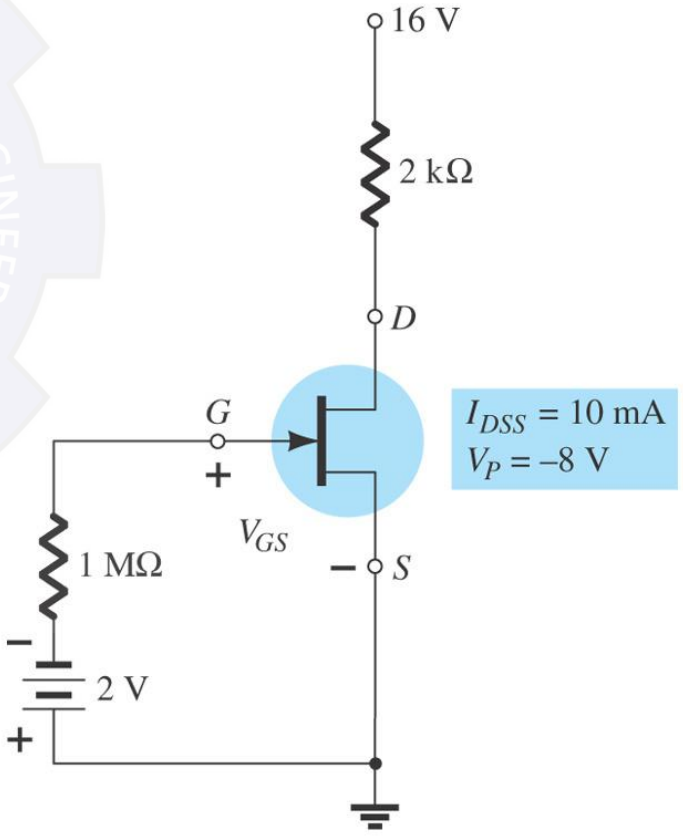
Example 7.1

Find V_{GSQ}, I_{DQ}, V_{DS}, V_D, V_G, V_S.

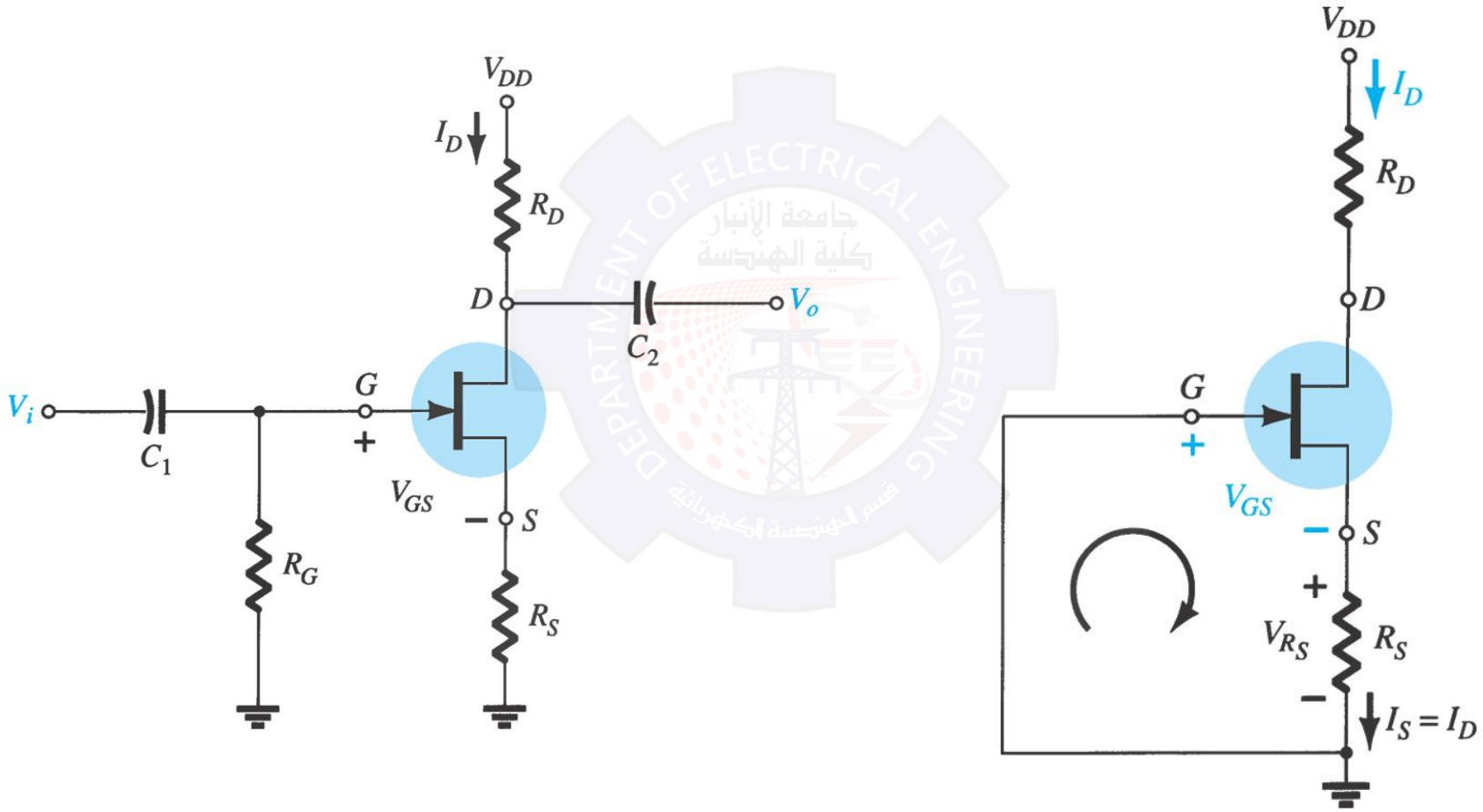


Example 7.1 - graphical solution





Self-Bias Configuration



DC analysis of the self-bias configuration.

Self-Bias Configuration

$$V_{GS} = -I_D R_S$$

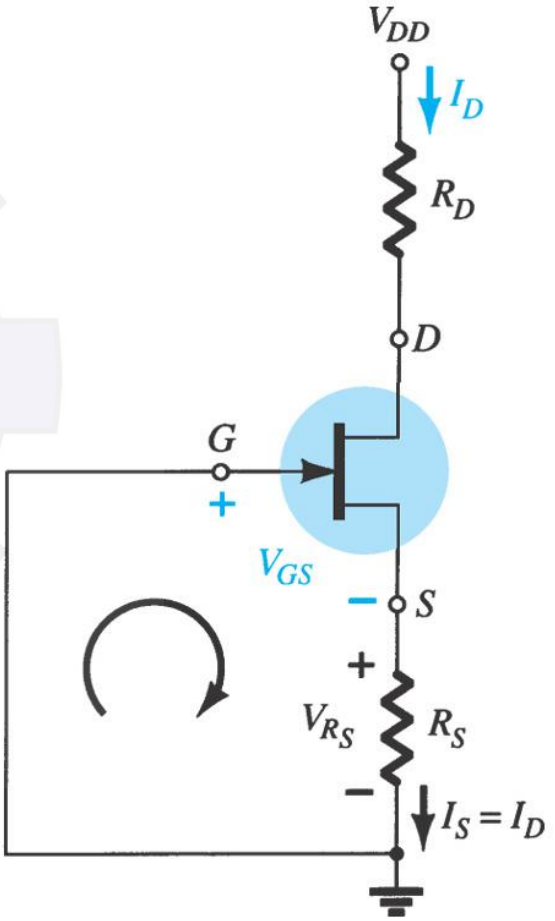
$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_p}\right)^2$$

$$I_D = I_{DSS}\left(1 - \frac{-I_D R_S}{V_p}\right)^2$$

$$I_D = I_{DSS}\left(1 + \frac{I_D R_S}{V_p}\right)^2$$

By squaring and rearranging, I_D has the form:

$$I_D^2 + k_1 I + k_2 = 0 \quad [\text{Solve for } I_D]$$



DC analysis of the self-bias configuration.

Self-Bias Configuration – graphical solution

- Sketch the transfer curve.
- Draw the line:

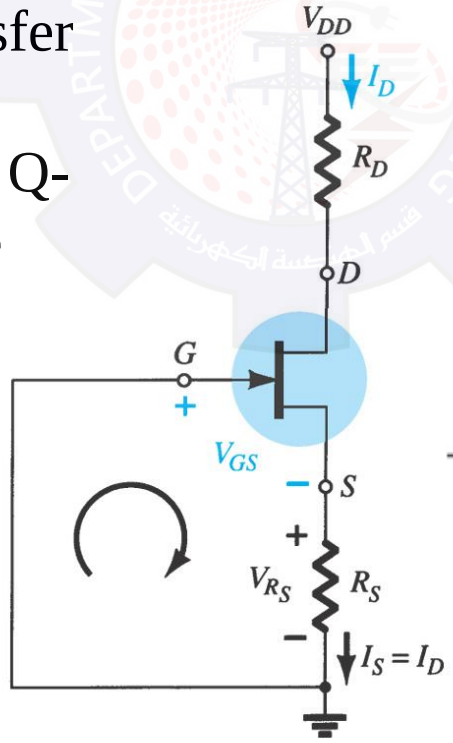
$$\mathbf{V_{GS} = -I_D R_S}$$

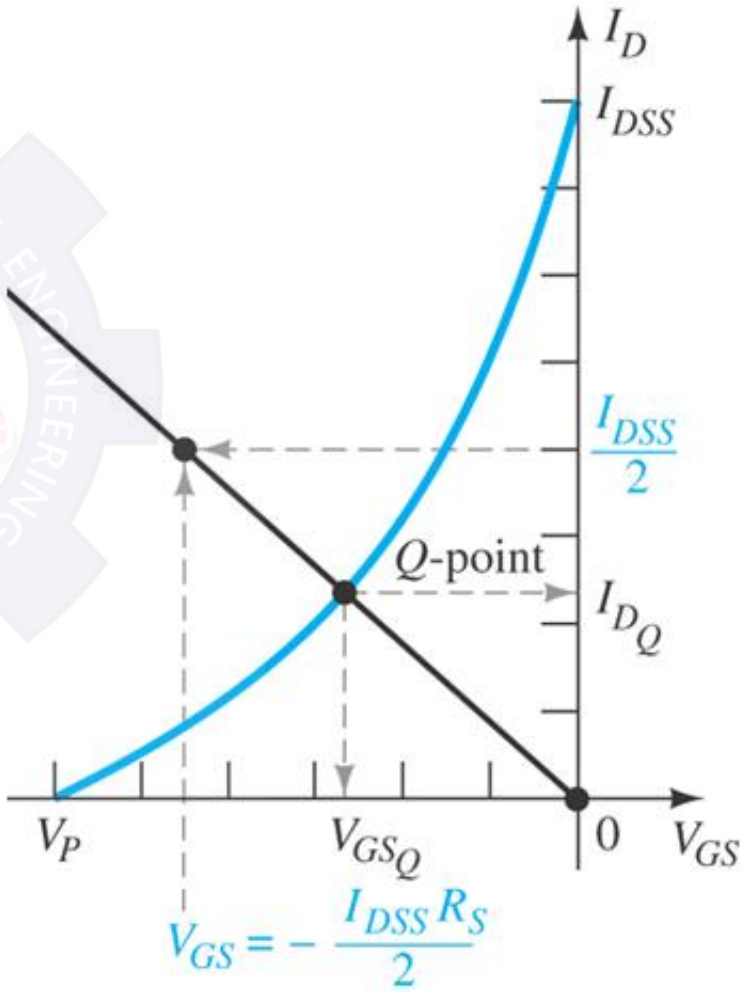
- The Q-point is located where the line intersects the transfer curve.
- Use the value of I_D at the Q-point (I_{DQ}) to solve for the other voltages:

$$V_{DS} = V_{DD} - I_D (R_S + R_D$$

$$V_S = I_D R_S$$

$$V_D \quad V_{DS} + V_S$$



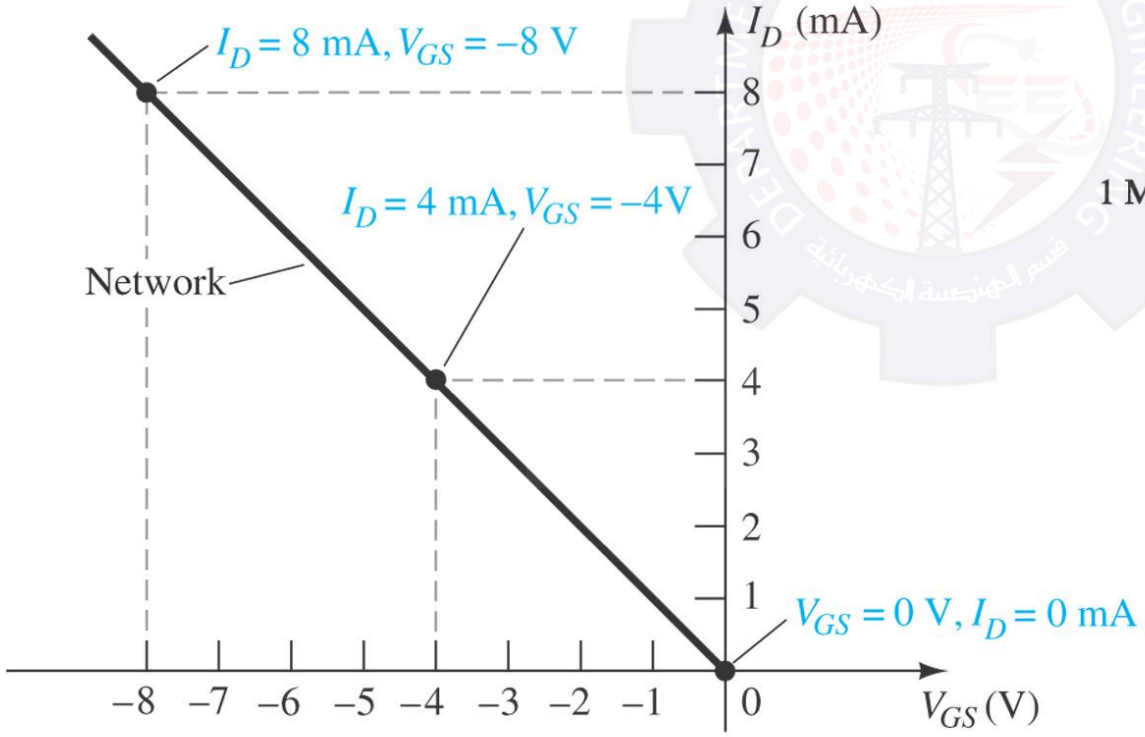


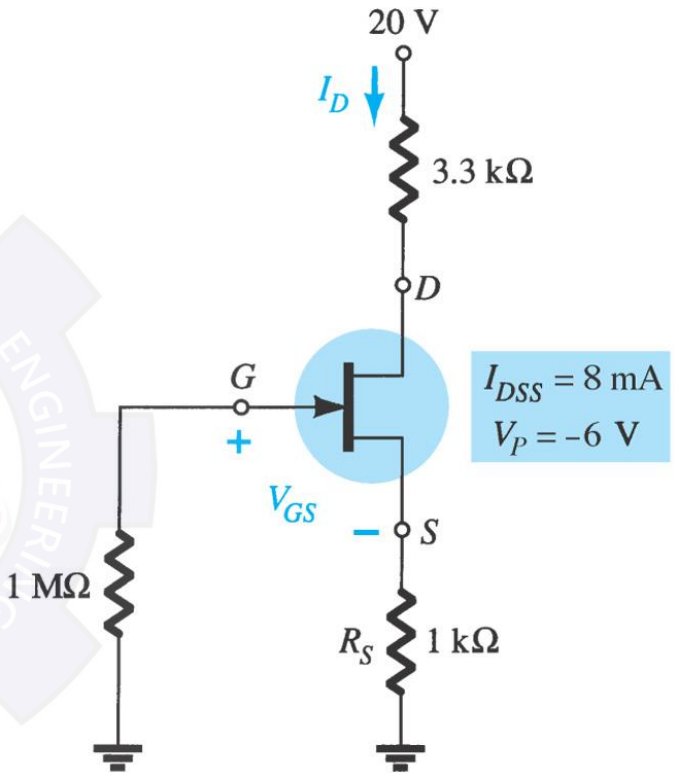
Example 7.2

Find V_{GSQ}, I_{DQ}, V_{DS}, V_D, V_G, V_S.

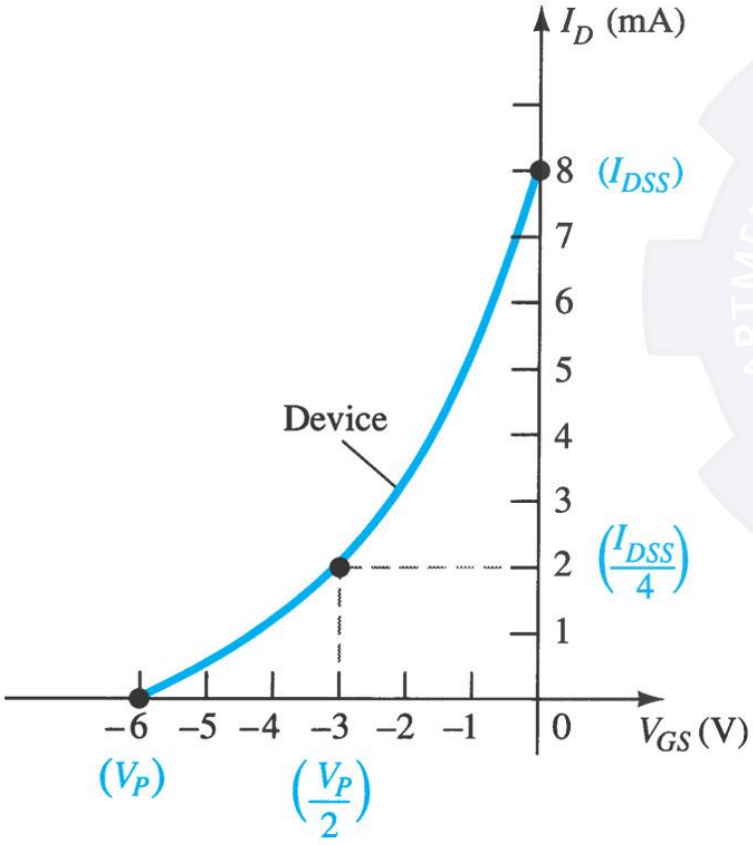
Solution

Draw the line: $\mathbf{V_{GS} = -I_D R_S}$

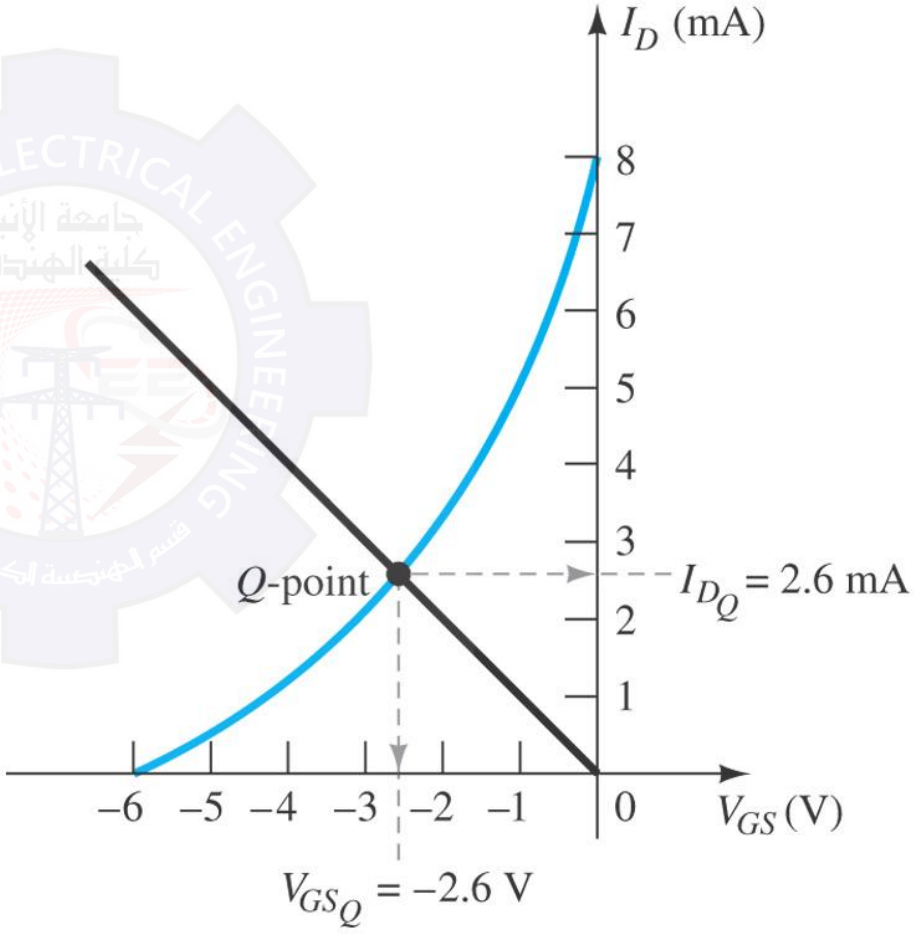




Example 7.2 - solution



Sketching the device characteristics for the JFET



Determining the *Q*-point for the network.