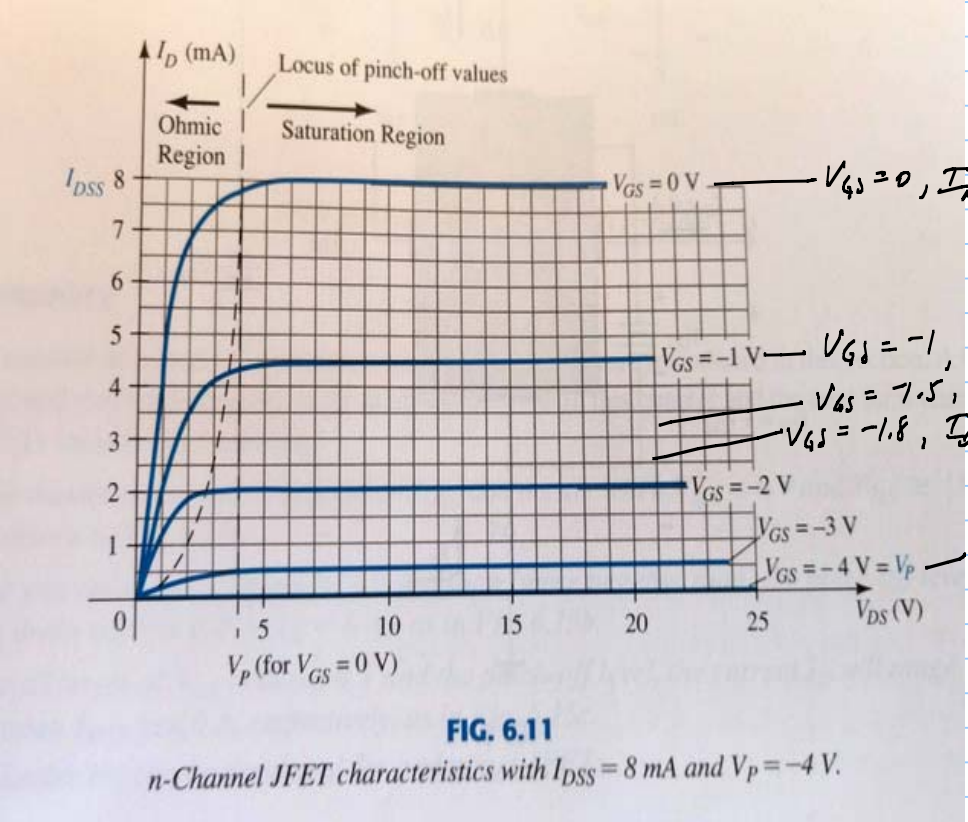
Chapter 6 #2, 8, 11a, 30, 32, 39

Note Title 8/11/2018

2) Using the characteristic curve below, determine I_D when $V_{GS} = 0, -1, -1.5, -1.8, -4, -6$ when $V_{DS} > V_p$.



$V_{GS} = 0$, $I_D = 8mA = I_{DSS}$

$V_{GS} = -1$, $I_D = 4.5mA$

$V_{GS} = -1.5$, $I_D = 3.25mA$

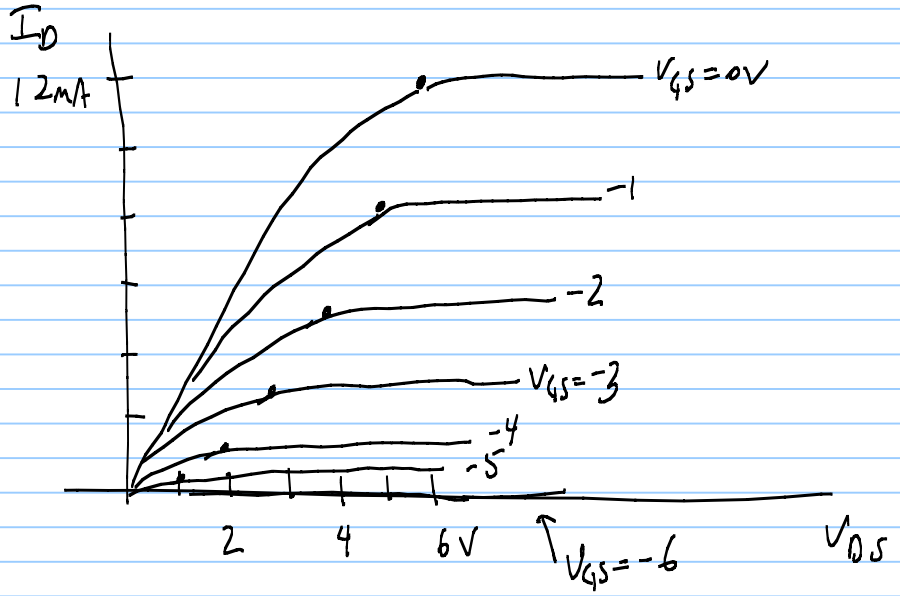
$V_{GS} = -1.8$, $I_D = 2.5mA$

$V_{GS} = -4$ & -6, $I_D = 0$

FIG. 6.11

n-Channel JFET characteristics with $I_{DSS} = 8$ mA and $V_P = -4$ V.

8) Given $I_{DSS} = 12mA$ and $|V_p| = 6V$, sketch the probable distribution of characteristic curves for the JFET (similar to 6.11 above)



$V_{GS} = 0$ & $I_D = I_{DSS} = 12mA$

$V_{GS} <= V_p = -6$, $I_D = 0$

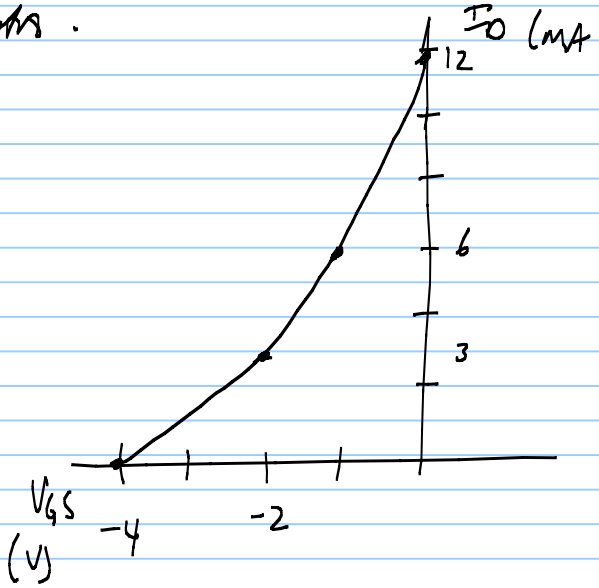
Using Shockley's equation

V_{GS}	I_D
$-1V$	8.33 mA
$-2V$	5.33 mA
$-3V$	3 mA
$-4V$	1.33 mA
$-5V$	0.33 mA

11a) Given $I_{DSS} = 12mA$ and $V_p = -4$, sketch the transfer characteristics for the JFET transistor.

Use table

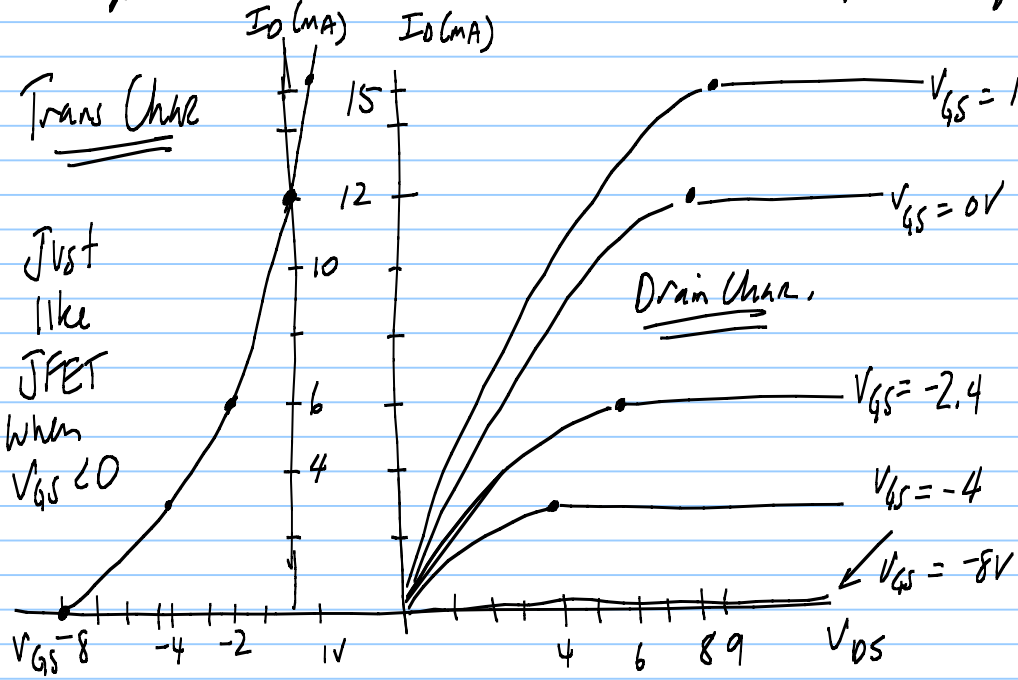
V_{GS}	I_D
0	$I_{DSS} = 12mA$
$-1.2 = 0.3V_p$	$I_{DSS}/2 = 6mA$
$-2 = 0.5V_p$	$I_{DSS}/4 = 3mA$
$-4 = V_p$	0



Can also generate table using

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

3a) Sketch the transfer and drain characteristics of an N-channel depletion type MOSFET with $I_{DSS} = 12mA$ and $V_p = -8V$ for the range of $V_{GS} = -V_p$ to $V_{GS} = 1V$



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

V_{GS}	I_{DSS}
$-8 = -V_p$	0
$-4 = -0.5V_p$	$I_{DSS}/4 = 3mA$
$-2.4 = -0.3V_p$	$I_{DSS}/2 = 6mA$
0	$I_{DSS} = 12mA$
1V	15.19 mA

$$I_D = 12mA\left(1 - \frac{1}{-8}\right)^2$$

$$= 15.19mA$$

unlike JFET, V_{GS} of N channel MOSFET can go positive

32) Given $I_D = 4mA$ at $V_{GS} = -2V$, determine I_{DSS} if $V_p = -5V$.

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

$$\frac{4mA}{\left(1 - \frac{-2}{-5}\right)^2} = I_{DSS} = 16.7mA$$

39) Given $K = 0.4 \times 10^{-3} A/V^2$ and $I_{D(on)} = 3mA$ with $V_{GS(on)} = 4V$, determine V_T.

$$I_D = K\left(V_{GS} - V_T\right)^2 \qquad 3mA = 0.4m\left(4 - V_T\right)^2$$

$$\sqrt{\frac{3mA}{0.4m}} = 4 - V_T = 2.74$$

$$V_T = 4 - 2.74 = \underline{\underline{1.26V}}$$