

ECEn 450, Winter 2009
Homework # 12
Due March 31, 5:00 pm

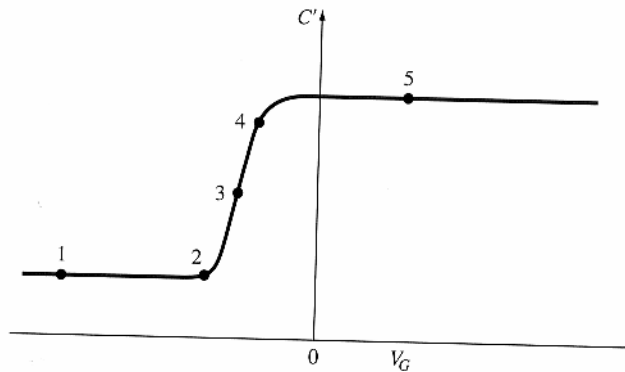
From the text Semiconductor Devices, Physics and Technology, do the following problems:

Chapter 6, problems 15, 18, 19

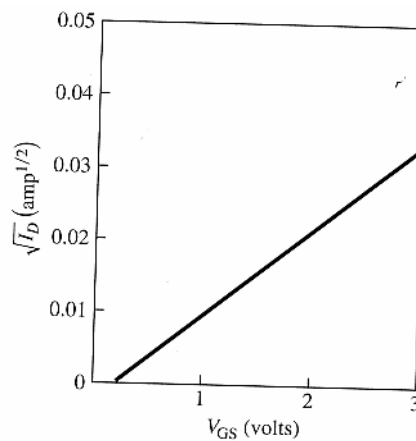
Chapter 12, problem 6

Also complete the following problems:

- 12.1 Consider the high-frequency C-V plot shown in the figure below. (a) Indicate which points correspond to flat-band, inversion, accumulation, threshold, and depletion mode. (b) Sketch the energy band diagram in the semiconductor for each condition.



- 12.2 The experimental characteristics of an ideal n-channel MOSFET biased in the saturation region are shown in the figure below. If $W/L = 10$ and $t_{ox} = 425$ Angstroms, determine V_T and μ_n .



12.3 One curve of an n-channel MOSFET is characterized by the following parameters:

$I_D(\text{sat}) = 2 \times 10^{-4} \text{ A}$, $V_{DS}(\text{sat}) = 4 \text{ V}$, and $V_T = 0.8 \text{ V}$.

- (a) What is the gate voltage?
- (b) What is the value of the conduction parameter?
- (c) If $V_G = 2 \text{ V}$ and $V_{DS} = 2 \text{ V}$, determine I_D .
- (d) If $V_G = 3 \text{ V}$ and $V_{DS} = 1 \text{ V}$, determine I_D .
- (e) For each of the conditions given in (c) and (d), sketch the inversion charge density and depletion region through the channel.