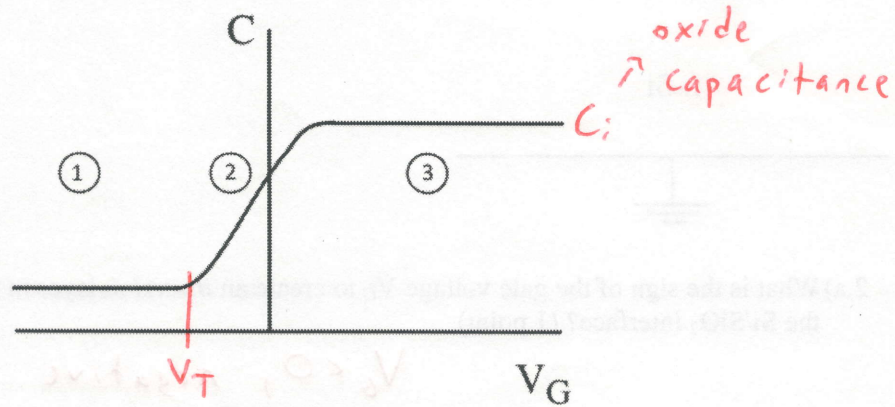


ECE 340: Quiz#3  
V2

Name: \_\_\_\_\_

1) Consider the C-V characteristic of a MOS structure, below.



1.a) Identify the three regimes of interface charge (i.e. accumulation, depletion or inversion) corresponding to each circle. (2 points)

① Inversion

② Depletion

③ Accumulation

1.b) On the diagram, identify the oxide capacitance. (1 point)

1.c) On the diagram, identify the threshold voltage. (1 point)

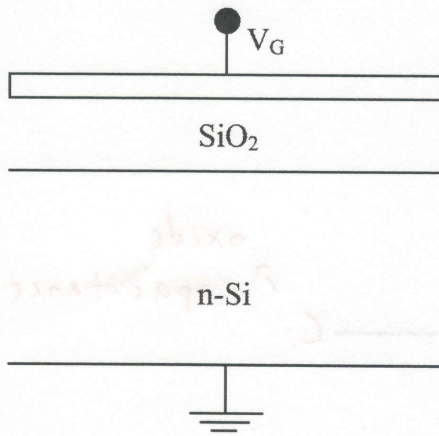
1.d) Is the semiconductor n-type, p-type or intrinsic? Explain. (1 point)

V<sub>Acc</sub> is when V<sub>G</sub> > 0, n-type  
or

V<sub>Inv</sub> is when V<sub>G</sub> < 0



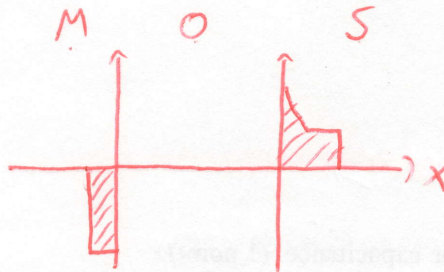
2) Consider a MOS capacitor with an n-Si substrate.



2.a) What is the sign of the gate voltage  $V_G$  to create an *inversion* layer in the semiconductor at the  $\text{Si/SiO}_2$  interface? (1 point)

$V_G < 0$ , negative

2.b) Draw the corresponding *block charge* diagram in the semiconductor, the oxide and the metal. (1 point)



2.c) Draw the energy band diagram across the whole system (i.e. metal, oxide and semiconductor) when the semiconductor is in *inversion*, and indicate schematically the position of  $E_i$ ,  $E_F$ ,  $E_c$  and  $E_v$ , and the positions of the  $\text{Si/SiO}_2$  and the  $\text{Metal/SiO}_2$  interfaces. (3 points)

