Week 12 Quiz ANSWERS: MOS IV
ECE 305: Semiconductor Devices
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Answer the multiple choice questions below by choosing the one, best answer.

1) The ON-current for an N-channel MOSFET occurs when the device is biased how? (The power supply voltage is \( V_{DD} \).
   a) \( V_{GS} = V_T, V_{DS} = V_{DD} \).
   b) \( V_{GS} = V_{DD}, V_{DS} = V_T \).
   c) \( V_{GS} = V_{DD}, V_{DS} = V_{DD} \).
   d) \( V_{GS} = V_T, V_{DS} = V_T \).
   e) \( V_{GS} = V_T, V_{DS} = 0 \).

2) The subthreshold swing is defined as:
   a) The increase in gate voltage necessary to increase the drain current by a factor of 2.
   b) The increase in gate voltage necessary to increase the drain current by a factor of 10.
   c) The increase in drain voltage necessary to increase the drain current by a factor of 2.
   d) The increase in drain voltage necessary to increase the drain current by a factor of 10.
   e) The increase in source voltage necessary to increase the drain current by a factor of 10.

3) What is the direction of current flow in N- and P-channel MOSFETs?
   a) Out of the drain for NMOS and out of the drain for PMOS.
   b) Out of the drain for NMOS and into the drain for PMOS.
   c) Into the drain for NMOS and into the drain for PMOS.
   d) **Into the drain for NMOS and out of the drain for PMOS.**
   e) None of the above.

4) What is the transfer characteristic of a MOSFET in the common source configuration?
   a) A plot of the drain current vs. the drain voltage.
   b) A plot of the drain voltage vs. the gate voltage.
   c) **A plot of the drain current vs. the gate voltage.**
   d) A plot of the gate voltage vs. the gate current.
   e) A plot of the gate voltage vs. the gate current.
5) For a long channel MOSFET biased “beyond pinch-off,” how does the saturated drain current vary with \(V_{GS} - V_T\)?
   a) As \( (V_{GS} - V_T)^{0.5} \).
   b) As \( (V_{GS} - V_T)^{1.0} \).
   c) As \( (V_{GS} - V_T)^{1.5} \).
   d) As \( (V_{GS} - V_T)^{2.0} \).
   e) As \( (V_{GS} - V_T)^{2.5} \).

6) For a short channel MOSFET biased at high \(V_{DS}\), how does \(I_{DSAT}\) vary with \(V_{GS} - V_T\)?
   a) As \( (V_{GS} - V_T)^{0.5} \).
   b) As \( (V_{GS} - V_T)^{1.0} \).
   c) As \( (V_{GS} - V_T)^{1.5} \).
   d) As \( (V_{GS} - V_T)^{2.0} \).
   e) As \( (V_{GS} - V_T)^{2.5} \).

7) How does the subthreshold drain current vary with \(V_{GS} - V_T\)?
   a) As \( \left[ \frac{(V_{GS} - V_T)}{(m k_B T)} \right]^{0.5} \).
   b) As \( \left[ \frac{(V_{GS} - V_T)}{(m k_B T)} \right]^{1.0} \).
   c) As \( \ln \left[ \frac{(V_{GS} - V_T)}{(m k_B T)} \right]^{0.5} \).
   d) As \( \ln \left[ \frac{(V_{GS} - V_T)}{(m k_B T)} \right]^{1.0} \).
   e) As \( \exp \left[ \frac{(V_{GS} - V_T)}{(m k_B T)} \right] \).

8) What is the minimum subthreshold swing at \(T = 300\) K.
   a) 30 mV/decade.
   b) 60 mV/decade. **Corrected**
   c) 90 mV/decade.
   d) 120 mV/decade.
   e) 150 mV/decade.