Fundamentals of Nanotransistors

L3.1 Quiz

ANSWERS

Mark Lundstrom
Purdue University

Lecture 3.1: Introduction (thermionic emission theory of the ballistic MOSFET)

1) Assuming Maxwell-Boltzmann statistics, what is the probability that an electron in thermal equilibrium at a temperature, *T*, can hop over an energy barrier of height ΔE?

a) $e^{-(E_F - \Delta E)/k_B T}$

b) $e^{-(\Delta E - E_F)/k_B T}$

c) $e^{-\Delta E/k_B T}$

d) $e^{+\Delta E/k_B T}$

e) $e^{-(\Delta E - E_C)/k_B T}$

2) What are the dimensions of the quantity, $(u_T L)/(2(k_B T/q))$?

a) cm/s

b) cm^2/s

c) cm/(V-s)

d) $\mathbf{cm^2/(V\text{-}s)}$

e) C/cm^2

3) Which of the following is true of the saturation current of a ballistic MOSFET? (Assume nondegenerate carrier statistics.)

a) $I_{DSAT} \mu (V_{GS} - V_T)^{1/2}$

b) $I_{DSAT} \mu (V_{GS} - V_T)$

c) $I_{DSAT} \mu (V_{GS} - V_T)^{3/2}$

d) $I_{DSAT} \mu (V_{GS} - V_T)^{2}$

e) $I_{DSAT} \mu (V_{GS} - V_T)^{5/2}$