Week 16 Lecture 40 Quiz:
Non-local Transport

ECE 656: Electronic Conduction In Semiconductors

Mark Lundstrom
Purdue University, Fall 2013
(Revised 12/1/13)

Student's name: _____

Answer the **multiple choice questions** below by choosing the **one, best answer**. Then **ask a question** about the lecture.

1) What does the term "injection velocity" refer to in a MOSFET?

   a) The velocity at the source end of the channel.
   b) The peak velocity in the channel.
   c) The average velocity in the channel.
   d) The average velocity in the source.
   e) The uni-directional thermal velocity.

2) Where in the channel does the velocity saturate in a nanoscale MOSFET under high drain bias?
   a) Wherever the electric field exceeds the critical field, $\mathcal{E}_C$.
   b) At the drain end of the channel.
   c) At the source end of the channel.
   d) It does NOT saturate in nanoscale MOSFET.
   e) Wherever the gradient of the quasi-Fermi level, $F_n(x)$, is the largest.

3) How does the on-current of a state-of-the-art n-channel SI MOSFET compare to it ballistic limit on-current?
   a) It is about 5% of the ballistic current.
   b) It is about 30% of the ballistic current.
   c) It is about 50% of the ballistic limit.
   d) It is about 80% of the ballistic limit.
   e) It is essentially at the ballistic limit.

(continued on next page)

4) In the linear region, the drain current is proportional to transmission, $\mathcal{T}$, but in the saturated region it is proportional to $\mathcal{T}/(2-\mathcal{T})$. Why?

a) Because the device transitions from "barrier-controlled" to "transmission-controlled".
b) Because the drain no longer acts as an ideal absorbing contact.
c) Because the source no longer acts as an ideal injecting contact.
d) Because of the need to satisfy MOS electrostatics.
e) Because the Landauer approach only applies to near-equilibrium transport.

5) In principle, the mobility that one deduces from the linear region current should decrease as the channel length decreases. Why?

a) Because of short-channel electrostatic effects.
b) Because the ballistic mobility becomes important.
c) Because of increased scattering in short channels.
d) Because of quantum effects.
e) Because of the increasing importance of series resistance.

6) What question do you have about this lecture?

You will NOT need to turn this quiz in