Week 6 Lecture 13 Quiz:
General Model for Transport

ECE 656: Electronic Conduction In Semiconductors
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Purdue University, Fall 2013
(Revised 9/27/13)

Student's name: _____

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

1) What are the special properties of a contact in the Landauer model?
   a) Strong inelastic scattering keeps them near equilibrium.
   b) Any electron incident upon the contact is completely absorbed (no reflections).
   c) Each contact is described by its own Fermi level.
   d) Contacts have a very large number of channels (modes) compared to the device.
   e) All of the above.

2) Which of the follow is true about the Landauer expression for current:
   $$I = (2q/h)\int \{\gamma \pi D(E)/2\}(f_1 - f_2)dE$$
   a) It applies to electrons in the conduction band.
   b) It applies to electrons in the valence band.
   c) It applies to holes in the valence band.
   d) It applies to **both** <u>electrons</u> in the conduction band and <u>holes</u> in the valence band.
   e) It applies to **both** <u>electrons</u> in the conduction band and <u>electrons</u> in the valence band.

3) What are the units of the quantity, $\gamma \pi D(E)/2$?

   a) Energy.
   b) One over energy.
   c) Ohms.
   d) One over Ohms or Siemens.
   e) The quantity is unitless.

4) What is meant by the term "near-equilibrium" transport?

   a) The contacts stay very close to equilibrium.
   b) The Fermi level in the contact is close to its equilibrium value.
   c) The Fermi levels of the two contacts, f_1 and f_2, can be replaced by the equilibrium Fermi level.
   d) The difference in Fermi levels between the two contacts can be replaced by a first order Taylor series expansion of $f_1 - f_2$.
   e) The temperature of the two contacts is the same.

5) Consider a small nano-device under bias with a steady-state current flowing. Which of the following is true?
   a) One contact tries to fill states in the device and the other one tries to empty them.
   b) Both contacts try to fill states in the device.
   c) Both contacts try to empty states in the device.
   d) All of the above.
   e) None of the above.

6) What question do you have about this lecture?

Turn in to Prof. Lundstrom in class on Friday.