Quiz Week 15
ECE 656: Electronic Conduction In Semiconductors
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Answer the **multiple choice questions** below by choosing the **one, best answer**.

1) What are the proper boundary conditions for the 1D BTE?
   a) The carrier densities at the two contacts.
   b) The incident and emerging fluxes at the two contacts.
   c) The incident and emerging fluxes at one of the two contacts.
   d) The incident fluxes at the two contacts.
   e) The carrier densities at the two contacts.

2) In a ballistic device, the states in the devices fall into what classes?
   a) Spin up and spin down states.
   b) Those fillable from contact one and those fillable from contact two.
   c) Those fillable from contact one, those fillable from contact two, and those not fillable.
   d) Conduction and valence band states.
   e) None of the above.

3) Consider a semi-classical ballistic device with two contacts. Which of the following statements is true?

   a) The population of states is described by Fermi functions in the contacts.
   b) The population of states in the device is described by two different Fermi functions.
   c) Well-defined Fermi levels exist in each of the two contacts.
   d) The distribution function in the device, $f\left(E\right)$, can be much different in shape from an equilibrium distribution, $f_0\left(E\right)$.
   e) All of the above.

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4) The density of states in a 1D semiconductor is $D_{1D}(E) = 1/(\pi\hbar)\sqrt{2m^*/(E - E_C)}$.
What is the "local density of states" in a ballistic device?

a) The above expression with the position-dependent conduction band edge, $E_C(x)$.
b) A concept that occurs only when quantum effects modify the density-of-states in a small device.
c) A concept that occurs in heterostructures when both $E_C(x)$ and $m^*(x)$ are position dependent.
d) The division of the DOS into parts fillable by each of the two contacts.
e) A quantity related to the DOS that depends on the local value of the quasi-Fermi level, $F_n(x)$.

5) Which of the following is true about a ballistic device with two, ideal Landauer contacts at different voltages?

a) The distribution function in the device is a Fermi-Dirac distribution with the average Fermi level of the two contacts .
b) The distribution function in the device is a Fermi-Dirac distribution with the Fermi level of the contact with the more positive potential.
c) The distribution function in the device is a Fermi-Dirac distribution with the Fermi level of the contact with the more negative potential.
d) Each state in the device is in equilibrium with one of the two contacts.
e) Each state in the device is in equilibrium with both the two contacts