Week 13 Lecture 32 Quiz:
Balance Equations: II

ECE 656: Electronic Conduction In Semiconductors

Mark Lundstrom
Purdue University, Fall 2013

Student's name: _____

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

1) When we write a balance equation for a quantity, n_ϕ, we always end up with an unknown, that we must write a new balance equation for. What is this unknown?

   a) The associated flux for the quantity.
   b) The generation term for the quantity.
   c) The recombination term for the quantity.
   d) The recombination time in the recombination term .
   e) The electron temperature.

2) What does the third moment of the BTE give us?

   a) The carrier continuity equation.
   b) The carrier flux equation.
   c) The carrier energy balance equation.
   d) The carrier energy flux equation.
   e) The carrier energy squared continuity equation.

3) What is the quantity, W_{xx} ?

   a) The total energy density.
   b) The kinetic energy density.
   c) The kinetic energy density associated with one of the degrees of freedom.
   d) The kinetic energy density associated with one of the degrees of freedom when the bands are parabolic.
   e) The kinetic energy density associated with one of the degrees of freedom when the bands are parabolic and the semiconductor is non-degenerate.

.

(continued on next page)

4) How is the hierarchy of balance equations terminated?

   a) By assuming near-equilibrium conditions.
   b) By assuming the Relaxation Time Approximation.
   c) By invoking the Onsager Relations.
   d) By expressing all of the quantities in the equations only in terms of quantities in the equations.
   e) By using the NEGF equation.

5) When we write the recombination term in the various balance equations as $R_\phi = \left(n_\phi - n_\phi^0\right) \Big/ \left\langle \tau_\phi \right\rangle$, sometimes a term corresponding to n_ϕ appears and a term corresponding to n_ϕ^0 **does not appear**. Why?

   a) Under near-equilibrium conditions.
   b) Under spatially uniform conditions.
   c) When the balance equation corresponds to a moment higher than 2.
   d) When the balance equation corresponds to a moment higher than 3.
   e) When the quantity in the balance equation is a flux.

6) What question do you have about this lecture?

Turn in to Prof. Lundstrom in class on Friday, Nov. 15.