Week 10 Lecture 24 Quiz:  
The BTE: Transport Coefficients

ECE 656: Electronic Conduction In Semiconductors  
Mark Lundstrom  
Purdue University, Fall 2013  
(Revised 10/30/13)

Student’s name: ____________________________

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

1) What is the quantity. \( \frac{1}{A} \sum_k (E - F_n(\vec{k})) \overline{\nu}(\vec{k}) f(\vec{\rho}, \vec{k}) \)? (\( E \) is the total energy.)
   a) The energy density.
   b) The energy flux.
   c) The heat density.
   d) The heat flux.
   e) The kinetic energy flux.

2) In this equation, \( \hat{C}_F = -\left( \frac{f(\vec{\rho}) - f_5(\vec{\rho})}{\tau_m} \right) \), what is \( f_5(\vec{\rho}) \)?
   a) The distribution function.
   b) The equilibrium distribution function.
   c) A distribution with the shape of the equilibrium distribution function.
   d) The Bose-Einstein distribution.
   e) The anti-symmetric part of the distribution function.

3) How do we interpret the quantity, \( \overline{\nu \overline{\nu}} \)?
   a) As a scalar.
   b) As a vector.
   c) As a second rank tensor.
   d) As a third rank tensor.
   e) None of the above.

4) For spherical bands, how is the average scattering time, \( \langle \langle \tau_m \rangle \rangle \) defined?
   a) \( \langle \nu_s^2 \tau_m \rangle / \langle \nu_s^2 \rangle \).
   b) \( \cdot \langle \nu_s^2 \tau_m \rangle / \langle \nu_s^2 \rangle \).
   c) \( \langle (E - E_C) \tau_m \rangle / \langle (E - E_C) \rangle \).
   d) All of the above.
   e) None of the above.
5) What is \( \frac{1}{\mu_{\text{tot}}} = \frac{1}{\mu_1} + \frac{1}{\mu_2} \) called?

a) The Thompson relation.
b) The Kelvin relation.
c) The Wiedemann-Franz law.
d) The Lorenz number.
e) Mathiessen’s rule.

6) What question do you have about this lecture?

Turn in to Prof. Lundstrom in class on Wednesday, Oct. 30.