Week 11 Lecture 26 Quiz:  
**Scattering: The Collision Integral**

**ECE 656: Electronic Conduction In Semiconductors**  
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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 the collision integral like this:

$$\hat{Cf}(\vec{r}, \vec{p}, t) = \sum_{\vec{p}'} S(\vec{p}' \rightarrow \vec{p}) f(\vec{p}') - \sum_{\vec{p}''} S(\vec{p} \rightarrow \vec{p}'') f(\vec{p})$$

What assumption are we making?

a) That the initial state is empty.  
b) That the final state is empty.  
c) The relaxation time approximation.  
d) That Fermi’s Golden Rule is valid.  
e) Equilibrium.

2) What does the condition, \( \sum_{\vec{p}} \hat{Cf}(\vec{r}, \vec{p}, t) = 0 \), imply?

a) The validity of the relaxation time approximation.  
b) Non-degenerate conditions.  
c) That electrons are conserved.  
d) Steady-state conditions.  
e) Equilibrium conditions.

3) When \( S(\vec{p} \rightarrow \vec{p}') = S(\vec{p}' \rightarrow \vec{p}) \), what type of scattering is involved?

a) Isotropic.  
b) Inelastic phonon absorption  
c) Inelastic phonon emission.  
d) Elastic  
e) Electron-electron.

4) Why is electron-electron scattering often neglected?

a) Because the scattering rate is usually weak.  
b) Because the overall momentum, energy, and number is conserved, so there is little effect on macroscopic parameters.  
c) Because it is mathematically (and computationally) hard to treat.  
d) All of the above.  
e) None of the above.
5) Electron-electron scattering is often treated to first order by assuming an equilibrium (Maxwellian or Fermi-Dirac) distribution with one change. What is the change?
   a) The Fermi level is replaced by the quasi-Fermi level.
   b) The lattice temperature is replaced by the electron temperature.
   c) The magnitude of the distribution is re-normalized.
   d) The Fermi-function is replaced by the Bose-Einstein function.
   e) None of the above.

6) What question do you have about this lecture?

   Turn in to Prof. Lundstrom in class on Friday, Nov. 1.