Week 2 Lecture 4 Quiz:
Density-of-States

ECE 656: Electronic Conduction In Semiconductors

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Purdue University, Fall 2013
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Student's name: _____

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

1) The 1D DOS is given by $D_{1D} = 2/(\pi\hbar\upsilon)$. What are the units of this expression?
   a) Joules^{-1}.
   b) Joules^{-2}.
   c) Joules^{-1} m^{-1}.
   d) Joules^{-1} m^{-2}.
   e) Joules^{-2} m^{-1}.

2) The 1D DOS is given by: $D_{1D} = 2/(\pi\hbar\upsilon)$. What bandstructure does this apply to?
   a) Parabolic.
   b) Spherical.
   c) Ellipsoidal.
   d) Linear.
   e) Any bandstructure.

3) A common way to describe a non-parabolic conduction band is $E(k)\left[1+\alpha E(k)\right] = \hbar^2k^2/\left[2m^*(0)\right]$. What does non-parabolicity ($\alpha > 0$) do to the density of state in k-space and energy space?

   a) Increases *DOS*(*k*) and increases *DOS*(*E*).
   b) Increases *DOS*(*k*) and decreases *DOS*(*E*).
   c) Decreases *DOS*(*k*) and increases *DOS*(*E*).
   d) Decreases *DOS*(*k*) and decreases *DOS*(*E*).
   e) Leaves *DOS*(*k*) unchanged and increases *DOS*(*E*).

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4) What is the quantity, $\left(1/A\right)\sum_{\vec{k}}\delta\left(E-E_k\right)$?

a) The number of electrons.
b) The density of electrons per cm^2.
c) The density-of-states in k-space.
d) The density-of-states in energy-space.
e) Unity.

5) Very often, it suffices to know the DOS only near the bottom of the conduction band and the top of the valence band. Why?
a) Because the DOS at higher (or lower) energies can be obtained by extrapolation of the DOS near the band edges.
b) Because the Fermi function ensures that states well above E_C are always empty and that states well below E_V are always full.
c) Because the bands become parabolic well above EC and well below EV.
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.