Week 6 Lecture 14 Quiz:
Modes and Transmission

ECE 656: Electronic Conduction In Semiconductors

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

1) Mathematically, the number of modes (channels) at energy, *E*, is proportional to what?
   a) The density of states.
   b) The velocity.
   c) The density of states times velocity.
   d) The density of states divided by velocity.
   e) The deBroglie wavelength.

2) How is the transmission, *T,* related to the mean-free-path for backscattering, λ, and the length of the resistor, L?

   a) $T = e^{-L/\lambda}$.
   b) $T = e^{+L/\lambda}$.
   c) $T = \lambda / L$.
   d) $T = L/\lambda$.
   e) $T = \lambda/(\lambda + L)$.

3) For parabolic band semiconductors, $M(E)$ is independent of energy (above the bottom of the conduction band) for which of the following cases?

   a) 1D
   b) 2D
   c) 3D
   d) 1D and 2D
   e) 2D and 3D

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4) Under what conditions does the Landauer expression for current,

$I = \frac{2q}{h}\int T(E)M(E)(f_1 - f_2)dE$, apply?

a) Near-equilibrium.
b) For near-ballistic transport conditions, $L << \lambda$.
c) For diffusive transport conditions, $L >> \lambda$
d) Far from equilibrium.
e) All of the above.

5) When should we NOT use the Landauer expression, $I = \frac{2q}{h}\int T(E)M(E)(f_1 - f_2)dE$?

a) When quantum transport is important.
b) When semi-classical transport dominates.
c) When the temperatures of the two contacts are different.
d) When hole conduction dominates.
e) When it is necessary to spatially resolve quantities inside the device.

6) What question do you have about this lecture?

Turn in to Prof. Lundstrom in class on Friday.