HW#5

(due 03/08)

Reading

(a) Omar (O) Ch. 5

(b) Handout 5 "Photonic crystals: Semiconductors of light" (see course website)

Problems

1. O Ch. 4 Q. 5
2. O Ch. 4 Q. 8
3. O Ch. 4 Pr. 10
4. O Ch. 5 Q. 2
5. O Ch. 5 Pr. 12
6. O Ch. 5 Pr. 14
7. Use the eq'n $m\left(\frac{dv}{dt} + \frac{v}{\tau}\right) = -eE$ for the $\bar{e}$ drift velocity v to show that conductivity at freq. ω is given by

$$\sigma(\omega) = \sigma_0 \frac{1 + i\omega\tau}{1 + \omega^2\tau^2}, \text{ where } \sigma_0 = \frac{ne^2\tau}{m}.$$

8. Kittel Ch. 7 Pr. 1 (see below)

9. Please describe, using info from Handout 5, recent developments in the field of photonic crystals. Use ≥4 sentences in your response.

Kittel Ch. 7, Pr. 1

1. ***Square lattice, free electron energies.*** (a) Show for a simple square lattice (two dimensions) that the kinetic energy of a free electron at a corner of the first zone is higher than that of an electron at midpoint of a side face of the zone by a factor of 2. (b) What is the corresponding factor for a simple cubic lattice (three dimensions)? (c) What bearing might the result of (b) have on the conductivity of divalent metals?