

# Topics to be covered on Exam 1

- All of lectures 1-13
- All of problem sets 1-4
- All assigned readings from the text book

## Words of advice:

When you study, emphasize materials in the following order: lectures, readings, problem sets

Don't bother to memorize numerical constants or complicated formulas. But you should know the simple formulas like  $\lambda v = c$  and  $n = c_0 / c$  for example. In general, understanding counts more than memorizing. The grade is assigned based on how much you understand, not what formulas you can memorize.

Most important of all: DON'T PANIC

# Outline of topics to be covered on Exam 1

What is a wave?

- the wave equation

- complex numbers and why we use them

- basic wave concepts:  $\omega$ ,  $\lambda$ , period, wave vector, etc.

Characteristics of electromagnetic waves

- transverse, not longitudinal

- electric and magnetic components

- complex amplitude, phase

- energy, irradiance, Poynting vector

Photons

- $E = h\nu$

- Photon flux, photon pressure

Where does EM radiation come from?

- concepts and terminology related to the EM spectrum

# Topics to be covered on Exam 1, continued

## Blackbody radiation

- Three ways that EM radiation can interact with atoms

- Boltzmann's Law

- Wien's Law

## Light-matter interactions

- forced oscillator model to find the induced polarization

- modified wave equation to find  $\alpha$ ,  $n$

- $\alpha$  and  $n$  depend on  $\omega$  of the light wave

- speed of light in a medium, irradiance in a medium

- normal and anomalous dispersion

- what if the electrons are not bound? the Drude model

- beyond the Drude model: plasmons

- optical properties of metals

# Topics to be covered on Exam 1, continued

## Light scattering

- coherent vs. incoherent scattering

- spatial distribution of scattered light

- Larmor formula and the Rayleigh law

## Reflection and refraction

- wave fronts

- spherical waves

- Huygen's Principle

- Snell's Law

## Reflection and transmission at interfaces

- s and p polarization

- Fresnel equations

- Brewster's angle

- transmittance and reflectance:  $R + T = 1$