ATSC5010
Homework #4 (Nov 13)

Due beginning of class November 20

1. Compute the wavelength of EM waves of the following frequency:
    a. Ultra-violet (UV) light – 10^{16} Hz
    b. Visible light – 7.5 X 10^{14} Hz
    c. Infrared light – 3 X 10^{14} Hz
    d. Microwaves – 3 X 10^{12} Hz
    e. Radiowaves – 3 X 10^{8} Hz

2. Consider a microwave signal from the Wyoming cloud radar (frequency 95 GHz); after traveling through a given medium for 1 km, its flux density has decreased by 20%. Determine the imaginary part of the complex index of refraction for that medium.

3. A visible light source emits 2 W of radiation uniformly. The wavelength of the light is 500 nm.
    a. How many photons per second are emitted by the source?
    b. What is the flux of photons (number of photons) through a 1 mm^2 surface at a distance of 1 km? 10 km? 100 km?

4. Given the following parameters: distance to moon—3.84X10^5 km; distance to sun—1.496X10^8 km; radius of moon—1.74X10^3 km; and radius of sun—6.96X10^5 km. Compute the following:
    a. Angular diameter (in degrees) subtended by the sun and moon;
    b. Solid angle subtended by the sun and the moon; and
    c. Which appears larger on earth and by how much?

5. The average broadband solar flux that reaches the top of the atmosphere is 1370 W m^{-2} measured on a plane normal to beam.
    a. Using the solid angle computed from question (4b), compute the average radiance of the sun's surface.
    b. Determine the incident flux density at 25 deg. latitude during the spring equinox at solar noon. (include a sketch to show how this was calculated)