## **OPAC101-INTRODUCTION TO OPTICS.** [Solved Problems (set2)]

**1.** What is the difference between the radiometry and photometry? *Answer: The only real difference between radiometry and photometry is that radiometry includes the entire optical radiation spectrum, while photometry is limited to the visible spectrum as defined by the response of the eye.* 

2. The solid angle of a half-sphere measured from a point in its center is

(a)  $4\pi$  sr

(b) 2π sr

(c)  $\pi$  sr

(d)  $\pi/2 \, \text{sr}$ 

**3.** The solid angle subtended at the center of a cube by one of its faces is

(a)  $2\pi$  sr

(b)  $\pi/2$  sr

(c)  $\pi/3 \, \text{sr}$ 

(d)  $2\pi/3$  sr

4. What is the SI unit of

(a) radiant intensity

(b) radiant flux

(c) radiance

(d) irradiance

(e) luminous intensity

(f) luminous flux

(g) luminance

(h) illuminance

**5.** For reading a book one needs a 50 lux illuminance. A bulb of 100 cd is used for illumination. Calculate the required distance of the lamb to the book.

**6.** Calculate irradiance and illuminace of a 10 mW laser pointer at 620 nm on an area of 4  $\text{mm}^2$ .

**7.**Table gives data on measured radiant power spectrum of a light source at various wavelengths measured in nm. Convert each radiant power given in watts to lumens and compute total luminous flux of the source.

λ(nm)	Φ(m₩)	$\Phi_{ m v}$ (lm)	
	400	2.52	
	450	6.11	
	500	0.20	
	550	6.25	
	575	8.49	
	700	0.15	

**8.**The light rays emerging from a point source of intensity 100 cd fall on a planar surface whose area is  $0.5 \text{ m}^2$  at distance 1 m from the source. The rays make an angle of  $37^\circ$  with the normal of a planar surface.



(b) Find the illuminance on the surface.

(c) Find the flux on the surface.

**9.** A 1000 cd-bulb is hang at a height of 4 mfrom the center of the floor of a room havingsquare shape with diagonal length of 6 m as shown in figure. Calculate the illuminance of the bulb at any corner of the floor.



**10.**A 1000 cd-bulb is hang at a height yfrom the center of the floor of a room havingsquare shape with diagonal length of 6 m as shown in figure. For which value of the *y* the illuminace at the bottom corner of the floor is maximum?



<ul><li><b>11.</b>A small, monochromatic light source, radiating at 500 nm, is rated at 500 W.</li><li>(a) If the source radiates uniformly in all directions, determine its radiant intensity.</li></ul>	<b>12.</b> A 1.5-mW helium-neon laser beam delivers a spot of light 5 mm in diameter across a room 15 m wide. The beam radiates from a small circular area of diameter 0.5 mm at the output mirror of the laser. Assume that the beam irradiance is constant across the diverging beam.	
(b) If the surface area of the source is 5 cm <sup>2</sup> determine the radiant excitance	(a) What is the beam divergence angle of this laser?	
(c) What is the irradiance on a screen situated 2 m from the source, with its surface normal to the radiant flux?	(b) Into what solid angle is the laser sending its beam?	
(d) If the receiving screen contains a hole with diameter 5 cm, how much radiant flux gets through?	(c) What is the irradiance at the spot on the wall 15 m from the laser?	
	(d) What is the radiance of the laser?	

**13.** Compare brightness' of two 100 mW laser pointers at 400,500 and 600 nm.

**14.** The threshold of sensitivity of the human eye is about 100 photons per second. The eye is most sensitive at a wavelength of around 550 nm. For this wavelength, determine the threshold in watts and in lumenof power.

15.The irradiance on the Earth (just above the atmosphere) is about 1350  $W/m^2$  due to Sun.

(a) What is the power of the Sun?

(b) What is the irradiance on Mercury and on Mars?