

## **Tutorial Sheet-1**

### **[Laser Technology and Applications, 16B1NPH533]**

1. (a) At what temperature are the rates of spontaneous and stimulated emission equal? Assume wavelength = 500 nm. [Ans: 41573K]  
(b) At what wavelength are they equal at 300 K? [Ans: 69.8 $\mu$ m]
2. Find the ratio of spontaneous emission to stimulated emission for a cavity of temperature 50 K and wavelength  $10^{-5}$  m. [Ans: Exp(28.8)]
3. A laser beam with an optical power of 5mW has a wavelength of 632.8 nm. Calculate the number of photons emitted per second. [Ans:  $1.6 \times 10^{19}$ ]
4. Find the ratio of population of the two energy levels at 300 K in a laser if the transition between them produces light of wavelength 694.3 nm. [Ans:  $9.25 \times 10^{-31}$ ]
5. The wavelength of emission is 600 nm and the lifetime is  $10^{-6}$  s. Determine the coefficient for the stimulated emission. [Ans:  $1.3 \times 10^{19}$ ]
6. Find the intensity of a laser beam of 20 mW power and having a diameter of 1.3 mm. Assume uniform intensity across the beam. [Ans: 1.5 kW/m<sup>2</sup>]
7. The ratio of population of two energy levels out of which upper one corresponds to a metastable state is  $1.059 \times 10^{-30}$ . Find the wavelength of light emitted at temperature 330 K. [Ans:  $1.1 \times 10^{-7}$ m]