Numericals on Laser Physics:

1. Show that a laser beam of wavelength 6000 Å is more coherent than a conventional beam of same wavelength. Given bandwidth of the conventional source is 1000 Å, that of laser source is 10 Å and LED is 100 Å.

2. He-Ne laser emits a wavelength of 6 $*10^{-5}$ cm. If the diameter of the emergent beam is 1 cm, calculate the angular divergence of this beam. If it is focused at a distance of 3.84 $*10^{8}$ metre calculate the spot size.

3. A Laser beam of wavelength 6000 Å and power 50 mWatt is allowed to pass through an aperture of 5 $*10^{-3}$ m and the beam is focused with a lens of focal length 50 cm. Calculate the spot size, areal spread and intensity.

4. Calculate the divergence of light beam issuing out of He-Ne laser, which produces spot diameter of 4mm and 6mm at 1 metre and 2m distance respectively.

5. A continuous He-Ne monochromatic laser beam of wavelength 632.8nm is chopped into 0.5 nanosecond pulses using some sort of chopper(shutter). Calculate the resultant line width, band width and coherence length.

6. Sodium D1 line has wavelength 5890 Å with spectral width 0.1 Å. Determine its coherent length, coherent time and Q value.

7. If sodium light consists of D1 and D2 lines of wavelength 5890 Å and 5896 Å. Determine coherent length, coherent time and Q value.

8. A pulse from a laser with power 1 Milli watt last for 10 nanoseconds. If the number of photons emitted per second is 3.491 $*10^{7}$, calculate the wavelength of the laser.

9. The ratio of population of two energy levels is 1.059 $*10^{-30}$. Find the wavelength of the light emitted at 330 Kelvin.

10. A laser operating at 632.8 nm emits 3.182 * 10^{16} photons per second. Calculate the output power of the laser if the input power is 100 watt. Also find the percentage power converted into coherent light energy.

11. A Ruby laser contains a crystal length of 4 cm with a refractive index of 1.78. The peak emission wavelength from the device is 0.55 micrometre. Determine the number of modes and their frequency separation.

12. An Nd-YAG laser has a cavity length of 50 cm and a rod length of 10cm. The index of refraction of Nd-YAG is 1.823. The remainder of the cavity is filled with air that has a refractive index of 1.0. Calculate mode spacing.