

Minor 1

PYL757- Statistical and Quantum Optics

Time: 01 Hour

Total Marks: 20

Date: 15/03/²⁰²¹~~2020~~

Note: All questions are compulsory. All symbols have their usual meaning unless otherwise stated. Questions are self-explanatory and no queries would be entertained. All steps must be shown during derivations and calculations.

1. What is the physical significance of complex degree of coherence in connection with second order coherence process? (02 marks)
2. Derive the relation between spectral density and auto-correlation function of a random stationary process. (02 marks)
3. Explain the van Cittert-Zernike theorem. Calculate the size of the partial coherence region at a distance of 2 meters from an incoherent Sodium lamp with aperture size of 50 micron. (1+2 marks)
4. Compare the Photon detection rates of a detector for identical powers of laser beams having quantum efficiency of 70%, for 600nm laser and quantum efficiency of 50%, for 800nm laser. (03 marks)
5. Differentiate between temporal and spatial coherence of a source. For a filtered Tungsten Halogen lamp (peak wavelength: 550nm) with circular aperture diameter 1mm and a screen placed 2 m away from the lamp, calculate the transverse coherence length of the source. (3+2 marks)
6. Starting from the Binomial distribution, derive the probability density function for a Poissonian distribution. Show that the variance of a Poissonian distribution scales as the mean of the distribution. (3+2 marks)