



Roll No.....

End Semester Examination, December 2024

B.Sc. (H) FS – V Semester

Physics V (BSFS309A)

Time: 2.5 hrs.

Max Marks: **50**

Note: ***All Questions are compulsory. Marks are indicated against each question.***

PART-A

Q.1 Attempt any five questions:

- (a) Compare the types of interference. [CO-1] [L-2] **2**
- (b) Give the importance of matrix method in paraxial optics [CO-3] [L-4] **2**
- (c) Explain the Statistical mechanics and its types. [CO-1] [L-2] **2**
- (d) Compare the interference patterns produced by Lloyd's mirror and Fresnel's biprism. What does this imply about the coherence properties of the sources? [CO-1] [L-3] **2**
- (e) In a Fresnel biprism experiment, the distance between the two virtual sources is 0.5 mm, and the screen is placed 1 m away. If the fringe width is 0.1 mm, calculate the wavelength of the light used. [CO-1][L-3] **2**
- (f) Two boxes contain 4 indistinguishable particles. If Box 1 has 3 states and Box 2 has 2 states, calculate the number of microstates if the particles are distributed equally between the two boxes. [CO-1] [L-] **2**
- (g) What is entropy [CO-4] [L-3] **2**

2x5

PART-B

Q.2 Describe the matrix methods in paraxial optics. Deduce the expression for translational matrix and reflection matrix. [CO-2] [L-3] **10**

OR

Discuss the principle of interference by the division of wavefront. Explain how Fresnel's biprism and Lloyd's mirror can be used to determine the wavelength of light. Provide experimental details for forensic applications [CO-2] [L-2] **10**

Q.3 Explain the concept of phase space. Drive the expression of phase space in terms of energy. [CO-4] [L-3] **10**

OR

Explain the concepts of microstates, macrostates, and thermodynamical probability. Deduce the expression for maximum thermodynamical probability. [CO-4] [L-3] **10**

Q.4 Explain the postulates of statistical mechanics. Derive the Boltzmann distribution law using the postulates of statistical mechanics. [CO-3] [L-5] **10**

OR

Discuss Planck's quantum hypothesis. Find the expression for total number of modes of vibrations between ν to $\nu + d\nu$. [CO- 3] [L-5] **10**

Q.5 Compare and contrast Bose-Einstein and Fermi-Dirac statistics. Explain the concept of Bose-Einstein condensation and its implications for zero-point energy in physical systems. [CO-5] [L-4] **10**

OR

Compare the Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Explain the concept of Fermi energy with figure diagram. An electron gas obeys the Maxwell-Boltzmann statistics. Calculate the average thermal energy (in eV) of an electron in the system at 300 K. [CO- 5] [L-5] **10**