CBCS B.Sc 6th Semester Sessional Examination, 2025
Paper: Statistical Mechanics
Paper Code: PHY-HC-6026

Marks: 20 **Time: 1 hour**

1. **Answer the following: (any two)** $2 \times 2 = 4$

(a) Differentiate between Fermi-Dirac and Bose-Einstein statistics.
(b) What is fermi gas? How is it different from other gases?
(c) What are Planck's oscillators?
(d) Write the definition of Microstate or Macrostate.
(e) Write down a few properties of thermal radiation.
(f) Explain the black body radiation curves.

2. **Answer the following: (any two)** $2 \times 3 = 6$

(a) Briefly explain: Photons obey Bose-Einstein statistics.
(b) State three properties of Liquid Helium.
(c) What is Fermi energy? Derive an expression for the same.
(d) What is the Wein's displacement law? How is it helpful in inferring information about stellar properties?
(e) Derive the entropy probability relation.
(f) State the Kirchhoff's law. Explain its significance.

3. **Answer the following: (any two)** $2 \times 5 = 10$

(a) What do you understand by Bose-Einstein condensation? Calculate the critical temperature at which the condensation will start.
(b) Using BE distribution law, derive Planck's law of black body radiation.
(c) Discuss the F-D distribution law.
(d) What is UV catastrophe? Show it in a diagram. Why were Rayleigh-Jeans law and Wein's law of energy distribution incomplete?
(e) What do you mean by ensemble ? Explain about different types of ensemble ? What is the minimum possible value of phase space in classical statistical mechanics ? $1+3+1=5$
(f) Derive the Maxwell-Boltzman distribution law of particles.
(g) Obtain an expression for normal radiation pressure.
(h) Establish the Stefan-Boltzmann law.