UPES
End Semester Examination, May 2023

Course: Statistical Physics
Program: BSc. (H) Physics
Course Code: PHYS 3004

Semester: VI
Time : 03 hrs.
Max. Marks: 100

Instructions:
1. **All questions are compulsory.**
2. **Questions 9 and 10 have internal choices.**
3. **Write your answers clearly and legibly.**
4. **All numerical problems must be solved using appropriate formulae and units.**

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the difference between microcanonical and canonical ensembles.	4	CO1
Q 2	Write down the equation for calculating the Mean Energy of a system.	4	CO1
Q 3	What do you understand by microstates and macrostates in statistical mechanics?	4	CO1
Q 4	Discuss the concept of entropy and its relationship with the probability distribution function.	4	CO2
Q 5	Determine the phase path of a linear harmonic oscillator in one dimension.	4	CO3

SECTION B
(4Qx10M= 40 Marks)

Q 6	Explain the difference between Bose-Einstein and Fermi-Dirac statistics with examples.	10	CO2
Q 7	Explain the terms "Emissive power" and "absorptive power". State and prove Kirchoff's law of radiation. What is its importance?	10	CO2
Q 8	Derive the relation $PV^{5/2}=$ constant for a classical ideal gas under a reversible adiabatic process.	10	CO2
Q 9	A coin is so loaded that the probability of getting 'head' in a toss is 0.7. Deduce the probability that in 5 tosses, we get (i) two heads and three tails, (ii) all tails, (iii) all heads. OR	10	CO3

	A system of 4 particles has energy levels with energies 0, 1, 2, 3 units. The total energy of the system is 3 units. List the accessible microstates if the particles are (i) indistinguishable (ii) distinguishable.		

SECTION-C
(2Qx20M=40 Marks)

Q 10	What do you understand by a weakly degenerate quantum system? Derive the conditions under which a system is known to be weakly degenerate and hence show why quantum effects are important for He gas at 273 K. OR What is the deference between a strongly degenerate FD gas and a strongly degenerate BE gas? Derive the conditions for Bose-Einstein condensation and discuss the properties of liquid helium.	20	CO4
Q 11	Derive Planck's radiation formula and show that Rayleigh-Jean's law and Wein's law are special cases of Planck's law.	20	CO2