Reg. No ..... Name **26U605**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2026

SEMESTER 6 : PHYSICS

COURSE : **19U6CRPHY09: THERMAL AND STATISTICAL PHYSICS**

(For Regular 2023 Admission and Supplementary 2022/ 2021/2020/2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. State the 2 conditions when the Quantum Statistics will converge towards Classical Statistics.
2. What necessitated the modification of ideal gas equation? Briefly explain.
3. What are thermodynamic functions? Why are they called thermodynamic potentials.
4. Write down the expression of Maxwell Boltzmann distribution function and explain the terms involved.
5. State first law of thermodynamics and show that it is a particular form of general law of conservation of energy.
6. Using Clausius-Clapeyron latent heat equations, explain the variation in melting point of a solid with pressure.
7. What is meant by thermodynamic equilibrium? What are the basic requirements to be strictly followed?
8. State and explain Rayleigh-Jeans law. Explain its validity in terms of experimental results.
9. What is meant by the term " principle of equal apriori probability"?
10. Show that slope of an adiabatic is γ times the slope of the isothermal.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. Differentiate between the Maxwell Boltzmann Distribution function and Bose Einstein Distribution Function.
12. Calculate the change in entropy when 10 g of water at 60 ^{O}C is mixed with 30 g of water at 20 ^{O}C.
13. Efficiency of a Carnot's cycle changes from 1/6 to 1/3 when source temperature is raised by 100 K. Calculate the temperature of the sink.
14. A heat engine working between two temperatures could theoretically convert one-eighth of the heat supplied into work. If the lower temperature is reduced by 95 ^{O}C, the theoretical efficiency would be doubled. Find the initial temperatures.
15. Differentiate between Bosons and Fermions - Give 2 examples each
16. 1 gram molecule of monoatomic perfect gas (γ = 5/3) at 27 ^{O}C is adiabatically compressed in a reversible prOcess from an initial pressure of 1 atmosphere to a final pressure of 50 atmosphere. Calculate the difference in temperature.
17. The opposite faces of a metal plate of 0.2 cm thickness are at a difference of temperature of 100 ^{O}C and the area of the plate is 200 sq.cm. Find the quantity of heat that will flow through the plate in one minute if K = 0.2 CGS unit.
18. A Carnot's engine absorbs 10^4 calories of heat from a reservoir at 627 ^{O}C and rejects heat to a sink at 27 ^{O}C. What is its efficiency? How much work does it perform? (1 calorie = 4.2 J).

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. What do you understand by critical constants of real gas? Explain briefly. Obtain expressions for three critical constants in terms of Van der Waal's constants.
20. What are thermodynamic potentials (functions)? Why are they known as potentials? Derive Maxwell's thermodynamic relations from thermodynamic potentials with state variables.
21. What is meant by the term ensemble? What is the use of using ensemble concepts in statistical ensembles? Discuss the major 3 classes of ensembles.
22. With necessary diagram, discuss the experimental results of Andrew's experiment on Carbon Dioxide and hence explain critical parameters of a gas.

(10 x 2 = 20)