QP CODE: 25020387

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Reg No : .....

Name : .....

# B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE / MERCY CHANCE EXAMINATIONS, FEBRUARY 2025

## Sixth Semester

## CORE COURSE - PH6CRT09 - THERMAL AND STATISTICAL PHYSICS

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

7A7F7ECA

Time: 3 Hours

Max. Marks : 60

### Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. What is critical temperature?
2. State Zeroth Law of thermodynamics.
3. What is reversible process? Mention the conditions for a process to be perfectly reversible.
4. What is a cyclic process? Give example.
5. State second law of thermodynamics.
6. Explain the term 'isentropics'.
7. Show that during a reversible adiabatic process the entropy of the system remains constant.
8. Name the thermodynamic potential functions of a thermodynamic system.
9. Write any two T.dS equations.
10. Write down the expression for average energy of a particle and explain the symbols.
11. Grand canonical ensemble can be considered as an open system. Why?
12. What are the characteristics of Bose particles?

(10×1=10)

### Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. The van der Waals constants for Carbon dioxide are a=1.32 x$10^4$N $m^4mole^{-2}$ and b=3.64 x$10^{-5}$ $m^3mole^{-1}$. Calculate the critical pressure and temperature.

14. A certain mass of an ideal gas at 27°C temperature and 8 atmospheric pressure, is expanded suddenly to 4 times of its volume. Find the final pressure and temperature.

15. Calculate the coefficient of performance of a Carnot refrigerator and a Carnot heat pump if both devices are operating between the reservoirs at -10°C and 40°C.

16. Derive Clausius –Clapeyron Latent heat Equation.

17. Briefly explain Lee's disc method for bad conductors.

18. An ice box is built of wood of 1.75 cm thick, lined inside with cork of 3cm thick. If the temperature of the inner surface of cork is $0^0$ C and that of outer surface of wood is $12^0$ C. What is the temperature of interface? The thermal conductivity of wood and cork are 0.0006 and 0.00012 CGS units respectively.

19. Calculate the energy radiated per minute from the filament of an incandescent lamp at 2000K, if the surface area is 5 X$10^{-5}$ sq. metres and its relative emittance is 0.85.

20. A free particle moves along a line of length L in the positive X-direction. Let the momentum of the particle be $p_x$ and energy be $E = c\,p_x$ where c is a constant. Obtain the density of states.

21. An atom has two energy levels $E_1$ = 0.2 eV and $E_2$ = 0.4 eV with degeneracies $g_1$ = 1 and $g_2$ = 2. In equilibrium at temperature T=300 K, the number of atoms in the lower energy level $E_1$ is n1=100,000. Find the number of atoms in the higher energy level $E_2$ using Maxwell-Boltzmann statistics. (Round-off the answer to nearest integer).

(6×5=30)

**Part C**

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Derive the relation between $C_p$ and $C_v$ using the concept of energy equation in the case of ideal gas and van der Waal's gas.

23. What is T-S diagram? Find the expression for efficiency of a reversible Carnot's engine with the help of T-S diagram.

24. State Stefan- Boltzmann law of radiation. Deduce this law on thermodynamic considerations.

25. What is FD statistics? What are the basic postulates used? Derive an expression for the most probable distribution of the particles governed by FD statistics.

(2×10=20)