QP CODE: 24000629

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Reg No : .....

Name : .....

# B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, MARCH 2024

## 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

DC91D513

Time: 3 Hours Max. Marks : 60

### Part A

*Answer any **ten** questions.*

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

1. How does a real gas differ from an ideal gas?
2. Explain the state of thermodynamic equilibrium.
3. State the significance and limitations of first law of thermodynamics.
4. Define molar specific heat capacity at constant pressure.
5. Define the coefficient of performance of a refrigerator.
6. Briefly explain the physical concept of entropy.
7. Show that adiabatic is steeper than isothermal.
8. State Third Law of Thermodynamics.
9. What do you understand by the term thermal conductivity?
10. State basic postulates of statistical Mechanics.
11. Briefly explain equipartition theorem.
12. What are fermions?

(10×1=10)

### Part B

*Answer any **six** questions.*

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

13. Explain variables of a state of a system and equation of state. Discuss the equation of state in case of ideal and real gas.

14. An ideal gas at 300 K performs work adiabatically to double its volume. Its temperature after expansion is found to be 290 K. What must be the temperature of the gas if the same work has to be performed isothermally? (Adiabatic index Y = 1.2, ln(2)= 0.693)

15. An irreversible engine absorbs $1x10^5$J of heat from source at 400K and rejects heat to a sink at temperature 200K. Can this engine deliver 6 $x10^4$ J work?

16. Define thermodynamic scale of temperature and show that this scale agrees with that of perfect gas scale.

17. Obtain the expression for change in Helmholz free energy dF using the relation between F and the internal energy U and the expression for dU.

18. Define thermodynamic potential enthalpy and obtain the Maxwell thermodynamic relation $(\partial T/\partial P)s = (\partial V/\partial S)p$.

19. Prove that thermodynamic relations $T.dS= Cv\ dT + T\ (\partial P/\partial T)_V\ dV$.

20. For a system at constant energy, the probability of any microstate is given to be 0.001. What is the total number of microstates the system at this energy?

21. What is occupation index? Under what conditions do B.E, F.D and M.B statistics give the same result.

(6×5=30)

## Part C

*Answer any **two** questions.*

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

22. Derive and discuss Van der Waals equation of state of a gas. Discuss the limitation of Van der Waals equation.

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. Derive Maxwell Boltzmann distribution law.

(2×10=20)