CENTRAL LIBRARY N.C.COLLEGE

TDC (CBCS) Odd Semester Exam., 2023

PHYSICS

(3rd Semester)

Course No. : PHSDSC/GE-301T

(Thermal Physics and Statistical Mechanics)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer *fifteen* questions, taking any *three* from each Unit : 1×15=15

UNIT—I

1. State zeroth law of thermodynamics.

2. Why has a gas two specific heats?

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3. The conduction of heat from cold body to hot body is reversible or irreversible. Why?

4. Which thermodynamic process is also called isentropic process?

UNIT—II

5. Write the equation of enthalpy in terms of internal energy, pressure and volume of the system.

6. Define Gibbs function (G).

7. Define Helmholtz function.

8. Write Clausius-Clapeyron equation.

UNIT—III

9. State Boltzmann law of equipartition of energy.

10. Define mean-free-path of a gas molecule.

11. Explain the conduction and diffusion in vertical cases.

12. What do you mean by transport phenomena?

UNIT—IV

13. What is blackbody radiation?

14. State Wien's distribution law.

15. What is the condition for a body to be perfectly blackbody?

16. State Stefan's law.

UNIT—V

17. Define phase space.

18. Define microstate.

19. Write down the relation between entropy and thermodynamic probability.

20. Who formulated quantum statistics?

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SECTION—B

Answer *five* questions, taking *one* from each Unit : 2×5=10

UNIT—I

21. How does entropy change in cases of reversible and irreversible process?

22. Why is C_p greater than C_v?

UNIT—II

23. Find the value of C_p / C_v for diatomic gas molecules.

24. Explain Joule-Thomson effect.

UNIT—III

25. State the assumptions of kinetic theory of gases.

26. How does mean-free-path vary with temperature and pressure?

UNIT—IV

27. What are the assumptions made by Planck to deduce Planck's radiational law?

28. Obtain Wien's displacement law from Planck's law.

UNIT—V

29. Name the particle which have zero or integral spin. Give one example of such particle.

30. What are the assumptions of MB-distribution?

SECTION—C

Answer *five* questions, taking *one* from each Unit : 5×5=25

UNIT—I

31. Find the work done in an adiabatic expansion of an ideal gas.

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32. A Carnot engine has an efficiency of 30% when temperature of the sink is 27 °C. What must be the change in temperature of the source to make the efficiency 50%?

UNIT—II

33. Derive both the *TdS* equations.

34. Show that $C_p - C_v = R / J$, where the symbols have their usual meanings.

UNIT—III

35. Using the law of equipartition of energy, find the expression for C_p and C_v for monoatomic and diatomic gases.

36. Deduce Clausius-Clapeyron equation using Maxwell's relation.

$$\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$$

UNIT—IV

37. Deduce Planck's radiation law.

38. Draw and explain the energy distribution curve of blackbody radiation.

(Continued)

UNIT—V

39. Derive Fermi-Dirac distribution law for an assembly of fermions.

40. Establish the relation $S = K \log \Omega$.

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