2022/TDC/ODD/SEM/PHSDSC/ GE-301T/153

TDC (CBCS) Odd Semester Exam., 2022

PHYSICS

(3rd Semester)

Course No. : PHSDSC/PHSGE–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

UNIT—I

1. Answer any *three* of the following questions :

$1 \times 3 = 3$

(a) What thermodynamic variable is defined by the zeroth law?

(b) Can two isothermal curves intersect each other?

(c) Does the internal energy of a gas change in an adiabatic process?

(d) Can heat be added to a system without increasing its temperature?

(*Turn Over*)

(2)

2. Answer any *one* of the following questions : 2

   (a) Why is C_P greater than C_V?

   (b) Distinguish between isothermal and adiabatic process.

3. Answer any *one* of the following questions : 5

   (a) Find the expression for work done during an adiabatic process.

   (b) Show that for a reversible cyclic process, the total change in entropy is zero.

UNIT—II

4. Answer any *three* of the following questions :

                                                                       1×3=3

   (a) What are four thermodynamical potentials?

   (b) Define internal energy.

   (c) Define Gibbs' function.

   (d) Write Clausius-Clapeyron equation.

(3)

5. Answer any *one* of the following questions : 2

   (a) In a throttling process $(Q = 0)$, the system suffers no change in enthalpy. Justify.

   (b) Find the value of C_P / C_V for a mono-atomic gas.

6. Answer any *one* of the following questions : 5

   (a) Derive the expression for temperature of inversion in Joule-Thomson expansion.

   (b) Use Maxwell's relation to show that

$$C_P - C_V = T \left(\frac{dP}{dT} \right)_V \left(\frac{dV}{dT} \right)_P$$

      and hence show that for a perfect gas $C_P - C_V = R$.

UNIT—III

7. Answer any *three* of the following questions :

                                                                        1×3=3

   (a) What is mean-free path of a gas?

   (b) State the law of equipartition of energy.

   (c) What is the effect of temperature on viscosity?

   (d) What is diffusion?

(4)

8. Answer any *one* of the following questions : 2

   (a) State the assumptions of kinetic theory of gas.

   (b) Write the expression of Maxwell's law of distribution of molecular velocities.

9. Answer any *one* of the following questions : 5

   (a) Derive the expression of diffusion coefficient D.

   (b) Use the law of equipartition of energy to find the expressions of C_P and C_V for mono-atomic and diatomic gases.

UNIT—IV

10. Answer any *three* of the following questions : 1×3=3

   (a) What is a perfectly black body?

   (b) What do you mean by spectral distribution of radiation?

   (c) State Weins' displacement law.

   (d) State Stefan's law.

(Continued)

(5)

11. Answer any *one* of the following questions : 2

   (a) A perfect black body is also a best possible emitter. Justify.

   (b) What are the assumptions made by Planck to deduce radiation law?

12. Answer any *one* of the following questions : 5

   (a) Deduce Stefan-Boltzmann law of radiation.

   (b) Deduce Wien's distribution law.

UNIT—V

13. Answer any *three* of the following questions : 1×3=3

   (a) Define macrostate.

   (b) Write the relation between entropy and thermodynamic probability.

   (c) Write True or False :

   Photons obey BE statistics.

   (d) Name one particle that obeys FD statistics.

(Turn Over)

14. Answer any *one* of the following questions :   2

    (a) What do you mean by phase space?

    (b) Distinguish between BE and FD statistics.

15. Answer any *one* of the following questions :   5

    (a) Establish the relation, $S = K \log \Omega$.

    (b) Deduce BE distribution law.

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