2019/TDC/ODD/SEM/PHSDSC/ PHSGE–301T/075

TDC (CBCS) Odd Semester Exam., 2019

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 : 1×3=3

(a) Name the thermodynamic process in which no heat enters or leaves the system.

(b) For which thermodynamic process $dU + dW = 0$ is valid?

(c) Temperature is a measurement of coldness or hotness of an object. This definition is based on which law of thermodynamics?

(d) For maximum efficiency of an engine with a given source of heat, what should be the temperature of the sink?

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

(a) Why is C_p greater than C_v?

(b) What are the limitations of first law of thermodynamics?

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

(a) Prove PV^{γ} = constant, for an adiabatic process.

(b) Define entropy. Show that the entropy remains constant in a reversible process.

1+4=5

UNIT—II

4. Answer any *three* of the following as directed : 1×3=3

(a) Which of the following is not a thermodynamical function?

(i) Enthalpy

(ii) Work done

(iii) Gibb's energy

(iv) Internal energy

(Choose the correct option)

(b) Define enthalpy.

(c) What is Joule-Thomson effect?

(d) Write the second TdS equation.

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

(a) "There is no change in the Gibb's function at constant pressure and temperature." Justify.

(b) Deduce first TdS equation.

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

(a) Using Maxwell's equation, show that for a perfect gas $\left(\frac{\partial U}{\partial V}\right)_T = 0$.

(b) Using Maxwell's equation, show that

$$C_p - C_v = T\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P$$

where symbols have their usual meaning.

UNIT—III

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

(a) Define mean free path.

(b) State the law of equipartition of energy.

(c) Define coefficient of viscosity.

(d) What do you mean by transport phenomena of gases?

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

(a) How does viscosity of a gas varies with temperature and pressure? 1+1=2

(b) Explain the process of diffusion.

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

(a) Derive Maxwell's velocity distribution formula for a gas.

(b) Derive the relation

$$\gamma = \frac{C_p}{C_v} = 1 + \frac{2}{f}$$

where f is the degrees of freedom.

UNIT—IV

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

(a) What is a blackbody?

(b) Define energy density in the context of radiation.

(c) Which law states that λ_m is inversely proportional to absolute temperature?

(d) Wein's law is valid in which region of wavelength?

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

(a) Write a short note on Wein's law.

(b) What is ultraviolet catastrophe?

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

(a) Derive Planck's radiation formula.

(b) Explain the blackbody radiation curve in detail.

UNIT—V

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

(a) Define phase space.

(b) Define microstate.

(c) What is meant by thermodynamic probability?

(d) Name one particle that follows BE statistics.

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

(a) What are the fundamental postulates of MB-distribution?

(b) What are the limitations of MB statistics?

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

(a) What are the postulates of BE statistics? Deduce the relation $S = k \log \Omega$. 2+3=5

(b) Distinguish between MB, BE and FD statistics in detail.

★★★