 KNU/2025/BSCPHSMN401

UG 4th Semester Examination-2025 (Under NCCF)
Award: - B.Sc
Discipline : Physics
Course Type : MNC-4 (Minor)
Course Code : BSCPHSMN401
Course Name : Fundamentals of Thermal Physics

Full Marks - 35 (Regular) **Time - 2 hours**

Section - A

1. Answer any *five* questions. **1×5=5**

a) Define degrees of freedom.
b) Write down the relation between thermal conductivity (K) and coefficient of viscosity (n) of a gas.
c) What is meant by adiabatic process?
d) Write down relation between entropy and thermodynamic probability.
e) What is ultraviolet catastrophe?
f) Which distribution law is obeyed by electron?
g) State law of equipartition of energy.
h) What is meant by 'phase space'?

Section - B

2. Answer any *five* questions. **2×5= 10**

a) Write down the assumptions of kinetic theory of gases.
b) What is meant by mean free path of a molecule in a gas?
c) What is an intensive variable in a thermodynamic system? Give example.
d) Show that adiabatic curve is steeper than isothermal curve.
e) Write the properties of black body radiation.
f) Comment on unattainability of absolute zero.
g) Show that Newton's law of cooling follows from Stefan-Boltzmann law.
h) Draw Fermi-Dirac distribution function at temperature T=0 K and T $\neq$ 0K.

Section - C

3. Answer any *two* questions. **5×2 = 10**

a) Write down the expression of Maxwell's Velocity distribution law and using this law find the expression of most probable velocity. 2+3

b) N particles obeying the Maxwell-Boltzmann Statistics are distributed among three states with the energies $E_1 = 0$, $E_2 = 2$, $K_b T$ and $E_3 = 3\ K_b T$. If the equilibrium energy of the system is 1000 K_bT, Calculate the total number of particles. 5

c) State Planck's formula of energy distribution in blackbody radiation. Show that Wien's formula and Rayleigh-Jeans formula are particular cases of Planck's formula. 1+4

d) With the help of Entropy -Temperature diagram of Carnot cycle, obtain an expression of efficiency of Carnot engine. 5

Section - D

4. Answer any *one* question. 10×1= 10

a) (i) Compare the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distribution functions. What is meant by 'Bose-Einstein condensation'?

(ii) On the basis of Kinetic Theory of Gases, deduce an expression for the coefficient of thermal conductivity of a gas. (3+2)+5

b) (i) State the zeroth law of thermodynamics. How does it introduce the concept of temperature.

(ii) Obtain an expression for work done in expanding a gas from volume V_i to V_f in an isobaric process. Two moles of an ideal gas occupy 0.035 m^3 volume at 2.6×10^5 N/m^2 pressure. It is expanded to volume 0.050 m^3 by isobaric process. Calculate the work done by the gas. (2+3)+(2+3)

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