RAN-2103000206021004

RAN-2103000206021004

T.Y.B.Sc. (Sem. VI) Examination March - 2025

Physics : Paper-IX

Statistical Mechanics And Special Theory of Relativity - PH-609

[Total Marks: 50

સૂચના : / Instructions

(૧) નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of ☛ signs on your answer book

Name of the Examination:

☛ **T.Y.B.Sc. (Sem. VI)**

Name of the Subject :

☛ **Physics : Paper-IX Statistical Mechanics And Special Theory of Relativity - PH-609**

Subject Code No.: **2103000206021004**

Seat No.:

Student's Signature

(2) Draw neat diagrams wherever necessary.

(3) Symbols used in the paper have their usual meaning.

(4) Figures to the right indicate full marks of the questions.

Q-I. Answer the following questions in brief. [10]

1) What is the value of C_v of hydrogen gas at room temperature?
2) Define the thermodynamic probability?
3) Magnons are ..... (Fermions' Bosons)
4) Why the fermions and bosons behave as classical particles at high temperature?
5) What do you mean by chemical potential?
6) Give the transformation equations for the component of force.
7) Why the hydrogen gas behaves as a monatomic gas below 60k?
8) In relativity can we accelerate the particle to infinite speed?
9) Explain how the kinetic Energy varies with velocity.
10) What is the difference between kinematics and dynamics?

Q-2 (a) Answer any one questions: **[07]**

1. Derive the Maxwell-Boltzmann distribution law.
2. Derive the expression for thermodynamic probability of N-distinguishable particle for a B.E. statistics.

Q-2. (b) Answer any one questions: **[03]**

1. Give the properties of quantum statistics.
2. For a gaseous molecule, the wave number is $540cm^{-1}$. Calculate the relative probabilities of first two vibrational mode at T= 1000K.

Q-3 (a) Answer any one questions: **[07]**

1. Considering Sackur-Tetrode equation explain Gibb's paradox.
2. What do you mean by an ideal gas? Deduce the expression of partition function for an ideal gas

Q-3 (b) Answer any one questions: **[03]**

1. Explain the concept of negative temperature.
2. Derive the expression $S = Nk_B lnz+\beta k_b U$.

Q-4 Answer any one questions:

(a) Explain in detail why the redefining of momentum in relativity is required. **[10]**

Q-4 (b) (1) Prove that in relativity acceleration is not parallel to applied force. **[05]**

(2) Explain longitudinal and transverse mass. **[05]**

Q-5 Answer any one questions:

(a) (1) 'The component of E parallel to relative velocity of the two frame is unchanged, whereas the component of E perpendicular to the relative velocity transform to mixed electric and magnetic field 'justified the statement in detail. **[07]**

(2) Is Maxwell's equation need to be modified for relativity? **[03]**

Q-5 (b) 'Whether an electromagnetic field is purely magnetic or purely electric, or electric and magnetic, depends on the inertial frame in which the sources are observed' justified the statement in detail. **[10]**
